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A Delphi Policy Analysis: Unit-Level Minimum Nurse-to-Patient Ratios in Acute Care Medical-Surgical Units in the United States

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A Delphi Policy Analysis: Unit-Level Minimum Nurse-to-Patient Ratios in Acute Care Medical-Surgical Units in the United States

A dissertation submitted in partial satisfaction of the

requirements for the degree

Doctor of Nursing Practice

by

Sarah Ann Horne Delgado

2023

ABSTRACT OF THE DISSERTATION

A Delphi Policy Analysis: Unit-Level Minimum Nurse-to-Patient Ratios in Acute Care Medical-Surgical Units in the United States

by

Sarah Ann Horne Delgado

Doctor of Nursing Practice

University of California, Los Angeles, 2023

Professor Nancy T Blake, Co-Chair

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Background: Surveys of nurses indicate that persistent and pervasive staffing deficits affect care delivery. A systematic review of longitudinal observational studies demonstrates that staffing levels impact patient outcomes, including mortality and length of stay. Studies of California's mandated patient-level ratios show mixed results in improving patient outcomes, though the policy is linked to higher nurse staffing levels and greater nurse satisfaction. A quasi-experimental study conducted in Australia showed that a unit level nurse-to-patient ratio policy in medical-surgical units led to improved staffing, reduced patient mortality, and shorter length of stay. **Objectives**: The aim of this project is to leverage diverse perspective in an analysis of a policy that requires minimum unit-level nurse-to-patient ratios in acute care medical-surgical

settings in the United States. Specifically, the project examines policy impact on staffing levels, patient length of stay and nurse attrition, and gathers input on potential unintended consequences, such as increasing healthcare costs or decreasing innovation. **Methods:** The Delphi Policy analysis involves inviting a diverse panel of participants to share their perspectives through a series of iterative surveys. For this project, 28 panelists including direct care nurses and health care leaders, were enrolled. Prior to completing the first survey, participants viewed a short presentation on the evidence related to ratio-based nurse staffing policy. Panelists completed the second and third surveys after reviewing the results of the prior survey. This process creates a virtual, anonymous dialogue between panel members. **Results:** In survey 1, participants demonstrated moderate agreement that the proposed policy would have a positive impact on staffing levels and patient length of stay, and less agreement regarding the effect on nurse attrition. Survey 1 also elicited a wide range of unintended consequences of the policy. In Survey 2, participants ranked the likelihood that these consequences would occur. In Survey 3, participants further examined the unintended consequences and the policy impact on different stakeholder groups. Results indicated an expectation that the policy will create positive change for nurses and patients, and conflicting views about the policy's effect on healthcare costs and care delivery innovation.

Conclusion: This project demonstrates that a unit-level ratio policy may benefit nurses and patients and will also have unintended consequences. Inclusion of direct-care nurses and healthcare leaders in policy development is crucial to identifying and mitigating the untended consequences that staffing policy will generate. This project also demonstrates that the Delphi policy analysis process is an effective tool for studying the divisive topic of staffing policy.

The dissertation of Sarah Ann Horne Delgado is approved.

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This dissertation is dedicated to my amazing, supportive, fun-loving family, which extends from suburban Maryland to Kirkland, Washington, and from San Francisco to San Gabriel, California. Parental and grand-parental support from Martha Horne, Lupe Delgado and Manuel Delgado was crucial to the completion of this project. An insightful question from Lucy Delgado inspired this project and I cannot thank her enough for that. In my neediest moment in this journey, Maya Delgado offered me empathy and kind advice. And to my partner in all things, in all times, Steven Delgado, whose constant encouragement and brilliant humor make me whole.

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CHAPTER ONE: INTRODUCTION

The delivery of acute care depends on the presence of a knowledgeable and skilled nursing workforce. Hospitals in the United States (U.S.) currently face wide variations in staffing levels (Lasater et al., 2021) and high rates of nurse attrition (NSI, 2022) affecting the quantity and quality of care available to acutely ill patients. A professional nursing organization defines appropriate staffing as the match between nurse competency and patient characteristics (American Association of Critical-Care Nurses (AACN), 2016). When the volume of patient needs exceeds the volume of nursing resources, that match is unattainable and inappropriate staffing results, negatively affecting patients, nurses, and healthcare teams.

Improving the current state requires a multifaceted approach, including effective policy interventions. Policy analysis involves an examination of different options, their impact on nurse and patient outcomes, and anticipated unintended consequences. The purpose of this project was to leverage diverse stakeholder views in an analysis of a policy that sets minimum unit-level nurse-to-patient ratios in adult medical-surgical units in U.S. hospitals.

The Problem

In a survey of nurses working in 254 different U.S. hospitals conducted prior to the coronavirus disease 2019 (COVID-19) pandemic, the mean number of patients per nurse in medical-surgical units ranged from 3.3 to 9.7, indicating wide variation in the amount of nursing care available to patients in these settings (Lasater et al., 2021). Additional studies demonstrate significant variation in staffing based on hospital type and location (Porcel-Gálvez et al., 2021; Smith et al., 2019; Tarazi et al. 2020). Differences in staffing levels are correlated to differences in patient outcomes. In repeated retrospective cross-sectional studies, a higher number of patients per nurse in acute care settings is associated with increased patient mortality within 30 days of

hospitalization (Aiken et al., 2021). Additional research demonstrates a correlation between exposure to low staffing and rates of hospital-acquired infection (Shang et al., 2019), episodes of missed care (Griffiths et al., 2018), and longer than expected patient length of stay (LOS) (Winter et al., 2021).

In addition to impacting patient outcomes, low staffing also contributes to nurse attrition, which reduces the pool of available nurses and increases the risk for inappropriate staffing. Surveys of nurses demonstrate that inappropriate staffing is a leading reason for intent to leave their current position (American Nurses Foundation (ANF), 2021; McKinsey & Company, 2021). In a January 2022 survey by the ANF, among nurses who identified as working in acute care settings, 97% reported that their organization had a staffing shortage. The staffing shortages were described as *a serious problem* by 64% and as a *moderate problem* by 33% of the sample. Among the same sample, 70% who reported intent to leave cited insufficient staffing as the reason (ANF, 2022). Additional evidence shows that nurses are increasingly leaving acute care positions. The 2022 Nursing Solutions Inc. report, which includes data from 272 hospitals for January 2021 through December 2021, finds a 27.1% rate of staff RN. That figure is ten percentage points higher than the same report found in any year since 2017 (NSI, 2022). Inappropriate staffing is thus a ubiquitous and self-perpetuating phenomenon that generates risks for patients who require acute care.

While inappropriate staffing is a repeated finding in surveys of nurses before and during the COVID-19 pandemic (ANF, 2022; French et al., 2022), a 2021 survey of healthcare leaders noted that executives also cite personnel shortages as their top concern (American College of Healthcare Executives, 2022). Similarly, the Emergency Care Research Institute (ECRI), a leader in independent healthcare technology evaluations, rated staffing shortages as the top patient

safety risk for 2022 (ECRI, n.d.). Evidence from within and beyond the nursing profession thus demonstrates a need for interventions that bolster nurse staffing.

The Business Case for Nurse Staffing

The financial structure of the U.S. healthcare system contributes to long-standing patterns of inappropriate staffing. Hospitals are not reimbursed for the volume of nursing care they provide, and nurses make up 17-25% of hospital budgets (Begley et al., 2020). Efforts to reduce costs by controlling reimbursement for hospital care create an incentive to reduce the number of hospital employees. Higher baseline nurse staffing may reduce expenditures on temporary or contingent staff, but in one analysis this savings did not fully offset the cost of higher baseline staffing (Saville et al, 2021).

Three studies find that adjusting the skill mix, the portion of care by different members of the health care team, so that a higher proportion of care is delivered by registered nurses (RNs), is cost effective, due to the association of RN care with fewer adverse events and shorter LOS (Martsolf et al., 2014; Li et al., 2011; Needleman et al., 2006). A retrospective review further finds that nurse sensitive adverse events increase patient LOS by an average of .48 days, confirming that staffing levels that reduce these events may result in cost savings that offset the cost of hiring more staff (Murphy et al., 2021). A 2009 analysis of the cost of increasing registered nurse staffing so that all hospitals reach what was then the 75th percentile for staffing concluded that 72% of the cost of adding nurses would be covered by the resulting savings in shorter LOS and increased person productivity. The authors of the analysis conclude that there may be a *market failure* in that financial incentives did not align with the best interests of our society (Dall et al. 2009).

A regression analysis of American Hospital Association (AHA) staffing data and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores from 2010 to 2012 found that higher staffing and higher skill mix were significantly correlated to improved patient experience (Oppel et al., 2018). This correlation could affect hospital budget decisions as Value Based Purchasing for Hospitals (VBPH) offers payment incentives based on HCAHPS scores. However, the correlation was not significant in the fixed-effects analysis, demonstrating that the relationship between staffing levels and patient experience warrants further study.

A longitudinal analysis compared Medicare beneficiary outcomes in hospitals with different levels of nursing resources and concluded that higher staffing levels improved outcomes without additional cost (Lasater et al., 2021b). A simulation study conducted in England found that higher baseline staffing improved patient outcomes and had a higher cost. An importance nuance in the simulation was that the reduced cost of lower baseline staffing was partially attributed to understaffed shifts when contingent staff were not available. The authors note that patients exposed to low staffing will have longer LOS, offsetting the savings of lower baseline staffing (Griffith et al., 2021). However, depending on the payment model, the cost benefit of shorter LOS may not translate to the budgets that drive staffing decisions.

A separate consideration in the business case for staffing is the cost of nurse attrition. When RNs leave a position, considerable cost is required to recruit and orient replacements. According to NSI's analysis, each percent change in nurse turnover costs a hospital $262,300 per year (NSI, 2022). Higher staffing levels that improve retention could reduce the cost of attrition.

Existing Policy Interventions to Address Nurse Staffing

In the U.S., federal guidance related to acute care nurse staffing includes Centers for Medicare and Medicaid Conditions of Participation (CoP), which apply to all hospitals that bill

Medicare and Medicaid. CMS CoP state that staffing must be *adequate* and that a registered nurse must oversee the hospital's staffing plan (CMS, 2017). In addition to federal guidance, states have implemented regulations related to acute care staffing through three models: nurse-to-patient ratios, staffing committees, and public reporting. California requires mandatory minimum nurse-to-patient ratios in all acute care units, while Massachusetts regulations set a minimum ratio only in intensive care units. Nine states require hospitals to make staffing decisions with input from committees in which at least 50% of the members are direct care nurses. Five states require that hospitals publicly report staffing levels. The remaining 35 states in the U.S. do not currently regulate acute care staffing (American Nurses Association, n.d.). Debates over state-based legislation setting specific nurse-to-patient ratios are an increasingly common phenomenon, demonstrating the need for further study of the efficacy and consequences of staffing policy.

CHAPTER TWO: THEORETICAL FRAMEWORK

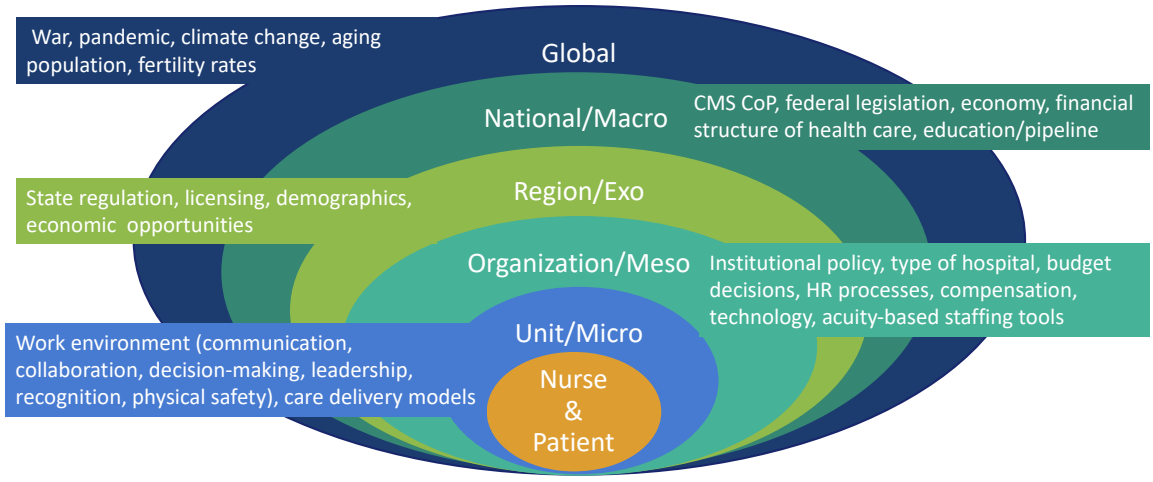
A socio-ecological model provides a framework for considering the complex and diverse factors that affect acute care nurse staffing. The Centers for Disease Prevention and Control (CDC) propose this model to identify the individual, relationship, community, and societal level factors that contribute to violence and the prevention strategies that can be implemented at each level (CDC, 2022). Similarly, an analysis of missed nursing care by Phelan and Kirwan (2020) applies the socio-ecological model and notes that care occurs in a context that influences and is influenced by choices and actions across different levels.

While a professional organization defines appropriate staffing as a match between patient needs and nurse competencies (AACN, 2016), multiple factors beyond patient need create the context in which staffing decisions are made. A socio-ecological lens demonstrates the source of these factors and clarifies options for improvement. Figure 1 provides a representation of a socio-ecological framework for acute care nurse staffing. As shown, factors at the global, national, state, and health system level impact the availability and deployment of nurses and thus influence the feasibility of aligning nurse competency and patient need.

This project examines the impact of a macro level or exo level intervention, a change in federal or state policy, on acute care nurse staffing. Notably, interventions at other levels of the model are needed. There is substantial evidence that micro-level, or unit-based interventions effect nurse staffing. For instance, a survey in which nurses rated the health of their work environment found that those who work in units that have implemented the American Association of Critical-Care Nurses' Healthy Work Environment Standards are less likely to report moral distress and intent to leave, and more likely to give rate their units as appropriately staffed (Ulrich et al., 2022).

The same study notes that the health of the acute care work environments deteriorated during the COVID-19 pandemic when surges of critically ill patients overwhelmed hospital resources. The data, collected in October 2021, showed lower ratings of the work environment than past surveys (Ulrich et al., 2022), demonstrating the urgent need for change. Seminal research demonstrates the inextricable link between nurse staffing and the work environment. In a study of 665 hospitals, higher staffing levels had a greater impact on patient mortality when the work environment was healthy (Aiken et al., 2012). A systematic review of research examining staffing and patient outcomes identifies the work environment as a mediating variable (Wynendaele et al., 2019). Thus, as demonstrated in the socio-ecological framework, the effectiveness of increasing the number of nurses through a macro level policy is contingent on concurrent efforts to address factors at the micro level, the work environment.

Figure 1: *Socioecological model for acute care nurse staffing*



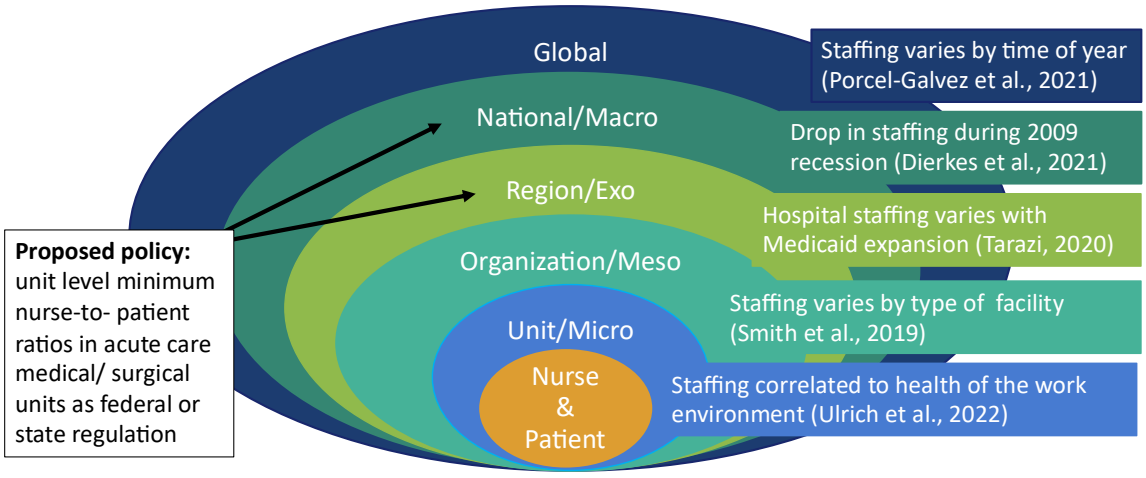
Evidence to Support Model Application

Three recent studies describe variation in nurse staffing levels consistent with the socio-ecological framework. In a retrospective randomized study, Porcel-Gálvez (2021) examined electronic health record data for 1004 patients cared for in medical-surgical units in Spain. The authors found that the season in which the hospital admission took place and the type of hospital

in which the care was delivered were significantly correlated to staffing levels during these admissions, while measures of patient acuity and patient dependency were not.

A study in the U.S. by Smith et al. (2019) suggests a similar variation in staffing levels based on hospital type. Analyzing responses to a Multi-State Survey, the authors found significant differences in staffing levels and skill mix between rural hospitals and urban settings. Nurses in large urban hospitals reported on average 4.8 patients per nurse, while nurses in isolated rural hospitals reported an average 7.3 patient-to-nurse ratio. Finally, Tarazi (2020) found significantly higher staffing levels in states that expanded Medicaid with the Affordable Care Act compared to those that did not. These results suggest a correlation between reimbursement for services and nurse staffing which, while economically rational, does not align with matching staffing to patient needs. Both Smith et al. (2019) and Tarazi (2020) were retrospective analyses and therefore subject to bias. However, cumulatively, these studies demonstrate geographic inequities in the distribution of nursing care in the U.S. A policy is one strategy that might reduce the magnitude of this inequity. Figure 2 summarizes the evidence to support the application of the socio-ecological framework to nurse staffing.

Figure 2: *Synthesis of literature supporting model application*



CHAPTER THREE: REVIEW OF LITERATURE

The literature search conducted in January 2022 and July 2022 included PubMed, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). The search used the terms "staffing", "policy" and "nurse" linked with the Boolean operator *and*. In CINAHL, auto-text populated a suggestion to expand the term *policy* to "policy or policies or law or laws or legislation" and the term *nurse*, to "nurse or nurses or nursing". Using the expansive terms returned 3460 articles. Applying limits for the past six years, peer-reviewed, research article, English language and the U.S. as the geographic region narrowed the pool to 135 articles.

From the pool of 135, articles about outpatient settings including nursing homes, articles that focused on a single diagnostic group and those about policies that do not affect medical-surgical unit staffing were removed. The remaining pool of 12 articles was reviewed and three were included in the Table of Evidence (see Table 1). A further search using the geographic area United Kingdom/Ireland and the same terms listed above yielded 70 articles, seven of which were selected for inclusion. Additional studies were identified through cross-referencing from systematic reviews and meta-analyses. Because research on nurse staffing policy continues to evolve, PubMed Alerts and Google Alerts were employed to identify newly published articles. PubMed and Google Scholar located articles identified through alerts and cross-referencing. In this section, the research pertaining to staffing policy and the correlation between staffing levels and patient outcomes are described.

Staffing Policy

A large retrospective study conducted in the U.S. leveraged the differences in policy implementation among the states to compare their impact (Han et al., 2021). Using American Hospital Association (AHA) data and a difference-in-difference design, the authors examined

staffing levels in 5188 hospitals and compared changes in productive hours per patient day for nursing assistive personnel (NAP), licensed practical nurses (LPNs) and registered nurses (RNs), over a 16-year period. Hospitals were grouped based on their location, in a state with no legislation to guide nurse staffing or in a state with one of three forms of nurse staffing policy.

In states that require a staffing committee, hospital staffing levels did not differ from staffing levels in states with no policy. The authors note that committees may be formed in compliance with the policy but may not be positioned to increase staffing (Han et al., 2021). The group of hospitals in states that mandated public reporting also did not show a statistically significant difference in NAP or RN hours. However, LPN hours in those states increased marginally compared to other states when California was removed from the analysis. The only state-based policy that was correlated to a significant positive impact on staffing levels was California's minimum nurse-level ratio policy (Han et al, 2021). Furthermore, California's policy correlated to an increase in both NAP and RN hours, though the policy only applies to RN staffing. This study demonstrates that a numeric policy can have a positive impact on staffing levels in U.S. hospitals, supporting the intervention in this project. Limitations of this study are that the data does not include unit-level analysis and that AHA's data does not clearly distinguish direct care nursing hours from administrative and managerial hours.

California Ratio Policy

The finding by Han et al. (2021) that California's ratio policy had a significant effect on staffing levels is confirmed by longitudinal analyzes of hospital staffing data before and after policy implementation (Dierkes et al., 2021). That same analysis showed stable staffing levels in California across a period of national economic recession when hospitals not subject to California's policy saw staffing declines (Dierkes et al., 2021). The policy and accompanying

increase in staffing levels is also consistently associated with improved outcomes for nurses, including higher job satisfaction, lower intent to leave and less risk of occupational injury (Serrat, 2013c; Twigg, et al., 2021, Leigh et al., 2015).

Studies of the impact of California's mandated ratio policy on patients show that while the policy did not lead to worse outcomes, it is also not consistently linked to improved outcomes. An early survey of randomly selected RNs in three states showed that nurses working in California hospitals regulated by the policy reported higher quality of care than nurses in other states without the policy (Aiken et al., 2010). A separate analysis divided hospitals into groups based on their pre-legislation staffing levels and found that with policy implementation, the hospitals that previously had the lowest staffing reported significantly lower rates of mortality in patients who had a hospital acquired complication (Spetz et al., 2013).

Other studies show that California's mandated ratio policy did not have a positive or negative impact on patient outcomes. Burnes-Bolton et al. (2007) reviewed data from California Nursing Outcomes Coalition and found that policy implement did not significantly change falls, pressure injuries or restraint use. Similarly, an analysis of discharge data showed that policy implementation was not associated with a change in rates of pressure injuries or failure to rescue (Cook et al., 2012). Given the diversity results, systematic reviews of California's policy and patient outcomes conclude that the evidence is ambiguous (Serrat, 2013b; Twigg et al., 2021).

Ratio policy in Queensland, AUS

A prospective quasi-experimental study conducted in Queensland, Australia offers strong evidence in support of unit-level minimum nurse-to-patient ratios in medical-surgical settings (McHugh et al, 2021). The policy, implemented in 2016, differs from California's policy in that the mandated minimum ratios do not address the number of patients assigned to each nurse or

coverage for nurses' breaks. The focus instead is on the number of nurses providing direct care to patients in each hospital unit during each shift. Decisions about how patients are assigned can thus be determined based on nurse competency and patient acuity without strict adherence to a nurse-level ratio.

While random assignment was not possible in this study, the authors were able to compare hospitals affected by the policy to hospitals in the same geographic area that were not affected, consistent with a quasi-experimental design. In addition, the researchers collected data from both groups of hospitals before and after policy implementation. Their results showed that intervention hospitals had significant improvements in staffing levels and patient LOS after policy implementation and that these changes were more profound than changes seen in the comparison hospitals not affected by the policy. While readmission rates increased in both groups, the increase in intervention hospitals was significantly less. The authors also demonstrated that increased staffing in intervention hospitals was cost-effective (McHugh et al., 2021). These results offer support for policies that require unit-level nurse-to-patient ratios. An important caveat is that there are differences between Australian and American healthcare systems that may affect the generalizability of these findings.

Staffing Levels and Patient Outcomes

A large body of research demonstrates a correlation between staffing levels and patient outcomes. Retrospective cross-sectional studies conducted in different countries over the past two decades establish a consistent correlation between staffing levels and patient mortality (Aiken et al., 2021). Longitudinal observational studies confirm this finding and unlike cross-sectional designs, also show the temporal relationship required to demonstrate a cause-and-effect relationship. Needleman et al. (2020) used payroll data to identify day and night shifts in which

staffing was less than 75% of the annual median unit staffing for that shift. Examining over 78,000 patients cared for over a 5-year period, the researchers correlated exposure to understaffed shifts to patient outcomes. Their work includes staffing levels for RNs and support staff (both LPNs and NAPs). The hazard ratio for in-patient mortality was significantly higher for patients exposed to low RN staffing, low support staffing and those exposed to shifts in which both conditions occurred. A strength of this study is that exposure to understaffed shifts preceded patient deaths, substantiating a cause-and-effect relationship. A limitation of the study is that data were collected in large urban hospitals and thus the results may not be generalizable to other settings (Needleman et al., 2020).

In a study with a similar longitudinal design, Winter et al. (2021) analyzed data from 143 Veteran's Affairs (VA) hospitals, including 438 general acute care units and 215 intensive care units. Their study linked exposure to understaffed shifts to higher-than-expected patient LOS. A strength of this study was the calculation of LOS which considered patient acuity by comparing actual stay with Medicare diagnostic-related group expected LOS. In accounting for patient condition by using the difference between actual and expected LOS, the study reduced the risk of *reverse causation.* Reverse causation occurs if higher levels of staffing are allocated to patients who are more sick and therefore more likely to have adverse outcomes, resulting in underestimation of the correlation between staffing and patient outcomes (Griffiths et al., 2016). A weakness of this study is that VA hospitals have unique operational procedures, including maintaining staffing levels when patient census falls. Therefore, the findings may be less applicable to other hospitals and health systems.

Because of their feasibility, many studies use a cross-sectional design, such as surveys of nurses about staffing levels. In a survey conducted just before the COVID-19 pandemic, French

et al. (2022) found significant concerns about staffing and patient safety among a large sample of registered nurses. 33,462 RNs answered the survey which was sent to all licensed nurses in Illinois and New York. Among the 89% of the sample who reported working in a hospital, 40.9% graded safety in their hospital as a C or below and 95% felt that better staffing would improve patient safety. In items that asked about the work environment, the lowest rated component among nurses working in hospitals was staffing. Importantly, one in five of the nurses who worked in hospitals reported intent to leave their current position, suggesting that staffing will be an ongoing concern. This study demonstrates that nurses associate inappropriate staffing with risks to patient safety, and that this concern existed before the Coronavirus-2019 pandemic.

Synthesis of Literature Review

The synthesis presented here describes the limitations of existing research on staffing and patient outcomes, and the correlation of staffing levels to the outcomes in this project, staffing levels, patient LOS, and nurse attrition.

Limitations of Existing Research on Staffing and Patient Outcomes

Systematic reviews of cross-sectional studies show that the correlation between staffing and patient mortality is consistent (Kane et al., 2007; Griffiths et al., 2016). However, cross-sectional data do not demonstrate the temporal relationship necessary for causal inference (Griffiths et al., 2016). Longitudinal studies that look at exposure to understaffing before a specific outcome occurs confirm the correlation between staffing and patient mortality and provide observational evidence of a cause-and-effect relationship (Dall'Ora et al., 2022). Such observational data may underestimate the relationship between staffing and mortality as patients

with higher acuity may be both more likely to die and more likely to be allocated to a higher level of staffing when strategies to staff according to acuity are in place (Griffiths et al., 2016).

An additional concern with large observational studies is that data aggregation may generate inaccuracies. Winter et al. (2021) demonstrated significant differences when data is aggregated by year and by hospital versus an analysis of monthly or unit-level data. One strategy to address this risk is to measure understaffing based on staffing patterns within individual units as in the study by Needleman et al. (2020). However, setting historic median staffing levels as the benchmark may be problematic in settings where staffing deficits are so frequent that historic medians reflect inappropriate staffing.

Reviews of empiric evidence related to nurse staffing and patient outcomes note that most studies are low-quality (Butler et al., 2019) or have inconclusive results (Twigg et al., 2021). There are barriers to conducting experimental studies of nurse staffing. Randomly assigning patients to different staffing levels is unethical and logistically impractical. Intuitively, more nurses equate to more care for each patient, improving patient outcomes. However, the limited supply of nurses working in acute care and the cost of employing them are considerations that affect staffing decisions and the economic viability of hospitals (Begley et al., 2019; Blouin & Podjasek, 2019). In addition, the number of nurses is not the only factor that influences patient outcomes, as demonstrated in the mixed results from studies of California's policy.

Analyses of retrospective studies note that variables not consistently measured such as the health of the work environment, patient acuity, and nurses' experience substantially impact the delivery of nursing care (Lake et al., 2019; Blouin & Podjasek, 2019; Griffiths et al., 2016). These omitted variables may confound the identified relationship between staffing levels and patient outcomes, risking both under and over-estimation of the correlation. In conclusion, while

existing evidence makes the association of nurse staffing to patient mortality indisputable, (See Figure 3) the implication of this finding as a basis for policy remains controversial.

Figure 3: *Synthesis table of staffing level impact on patient outcomes*

ARTICLE	Type of study	Inpatient mortality	30 day mortality	Length of stay	Failure to rescue	Pressure injury	Missed care	Hospital aquired pneumonia	Re-admissions	Hospital acquired infections	Respiratory failure
Kane et al. 2007	systematic review of 28 studies	++			++			++			+
Cook et al. 2012	before/after ratio policy, analysis of discharge data				0	0					
Spetz et al. 2013	before/after ratio policy implementation	++		++	0	0		0		0	0
Flanagan et al. 2016	Retrospective, a linear model of pneumonia								++		
Griffiths et al. 2018a	systematic review, 18 studies						++				
Griffiths et al. 2018b	retrospective, longitudinal, cohort study	++									
Driscoll et al., 2019	systematic review, meta-analysis of 35 cross sectional	++	+			+		+		+	
Haegdorens et al. 2019	retrospective observational, longitudinal study	++		0							
Shang et al., 2019	Retrospective observational, longitudinal study									++	
Butler et al., 2019	Cochrane Review, 19 studies of specialist nurse or primary	0		0		0			+		
Needleman et al. 2020	Retrospective, longitudinal study	++									
McHugh et al. 2021	Prospective quasi-experimental study		++	++					++		
Musy et al. 2021	Retrospective, observational study	++									
Lasater et al. 2021	Modeling from cross-sectional- survey and Medicare data	++		++							
Winter et al. 2021	retrospective, longitudinal study			++							
Aiken et al. 2021	cross sectional study of staffing and patient outcomes in	++	++	++					++		
Dietermann et al. 2021	Multilevel regression of unit level staffing and nurse sensitive	+				+		+	+		++
Zaranko et al. 2022	Retrospective, longitudinal study	++									
Dall'Ora et al. 2022	Systemic review of longitudinal studies	++		+		+					

0= no correlation, + = correlation that was not statistically significant; ++= statistically significant correlation. None of the studies reviewed here show worse patient outcomes with higher staffing levels

Impact of Staffing Policy on Staffing Levels

Nurse staffing is a global concern, and international experiences offer evidence regarding policy interventions. Table 1 provides examples of existing nurse staffing policies.

Table 1: *Acute care staffing policies and their impact*

Location	Policy and Description	Evidence of impact
Victoria and Queensland, Australia	Unit level minimum nurse-to-patient ratios establishes numeric guidelines based on shift at the unit level. Patient assignments are a local decision. For medical-surgical units: • Day ratio- 1:4 patients • Night ratio- 1:7(Queensland), 1:8 (Victoria) • Skill mix- Victoria requires 80% RN	• Policy led to increased staffing levels, reduced patient LOS, and fewer readmissions compared to hospitals without the policy. • Increasing nursing workload by 1 patient per nurse increased mortality. • Demonstrated cost-effectiveness (McHugh et al., 2021)
California, United States	Nurse level minimum nurse-to-patient ratios establishes a fixed nurse-to-patient ratio for each type of unit. Adjustments based on patient acuity increase staffing above the set minimum but cannot go below it. Affects break coverage as ratio must be always maintained. For medical-surgical units: • Ratio at all times- 1:5 • Skill mix- max of 50% LPNs in ratio	• Increased RN and NAP staffing levels, no change in LPN (Han et al, 2021). • Staffing level increase was consistent in recession (Dierkes et al., 2021) • Reviews shows mixed/inconclusive impact on patient outcomes (Burnes-Bolton et al., 2007) • Consistent evidence of improved nurse outcomes (Twigg et al, 2021)
Ireland	Staffing level must be adjusted based on patient acuity. Acuity assessment and unit type are used to calculate the required hours of nursing care per day and per year and full-time positions are adjusted accordingly	Early evidence of increased staffing levels, and improved work environment. Policy implementation is too recent to measure other impacts (Van Den Heede et al., 2020)
England	National guidance that is locally managed (not a law): endorses use of acuity tools, professional judgment, reporting of staffing levels. Only numeric guidance is noting a risk of harm when the ratio is 1:8 or higher	Preliminary evidence of increased staffing levels, less intent to leave, more interest in nursing careers. (Van Den Heede et al., 2020)
8 states in United States	Staffing committees: hospitals must appoint a staffing committee with 50% or more members being direct care nurses	Analysis shows no statistically significant change in RN staffing levels with this regulation (Han et al., 2021)
5 states in United States	Mandatory reporting: hospitals must publicly report their staffing levels	Analysis shows no statistically significant change in RN staffing levels with this regulation (Han et al., (2021)

Queensland and California both have policies that set a mandatory minimum number of nurses, and these are associated with higher staffing levels (McHugh et al., 2021; Han et al., 2021). The remaining policies listed in Table 2 influence the process by which staffing decisions are made. Current evidence demonstrates that those policies have less impact on staffing levels or an impact that has not yet been measured. As noted by Van den Heede et al. (2020), more evidence is needed regarding policies like Ireland's that require acuity-based staffing. In addition, there may be strategies for making staffing committee legislation more impactful, such as ensuring that such committees have influence over staffing levels (Han et al., 2021).

As Manley (2013) describes in discussing the Delphi policy analysis methodology, policy decisions must consider anticipatable unintended consequences. While the evidence shows a connection between nurse staffing and patient outcomes, a numeric policy that assures a specific volume of resources will have diverse impacts on the delivery of health care and the environment in which nurses work. Unintended consequences are less often addressed in empiric or observational research and are amenable to exploration with the Delphi policy analysis approach used in this project.

Impact of Staffing levels on LOS

The patient outcome in this project is LOS. Shorter LOS was a significant finding in McHugh et al.'s prospective quasi-experimental study of a unit-level minimum ratio policy in Queensland (2021). In addition, the cost savings from shorter LOS were nearly twice the cost incurred from hiring additional nurses to medical-surgical units (McHugh et al., 2021). Evidence that ties staffing policy to LOS thus demonstrates a potential financial benefit to implementation.

In describing LOS as an outcome, Winter et al. (2021) noted that while LOS is less specific than other outcomes such as rates of pressure injury or hospital-acquired infection, LOS

serves as a *combined indicator* of the efficiency of hospital care. Patients are discharged in a timely manner when nurses prevent complications and delays in care, promptly intervene to address changes in condition and prepare patients for the transition to outpatient care. An analysis of missed care found that patient education and discharge planning are among the most often skipped interventions (Chaboyer et al., 2021). In addition to the cost saved through fewer hospital days, patients with shorter LOS also have a less risk of complications because they spend less time in the hospital. Therefore, LOS is an outcome that panel participants considered in the proposed project.

Impact of Staffing Levels on Nurse Attrition

While nursing outcomes such as job satisfaction, burnout, and attrition are not traditional goals of federal or state policy, recent initiatives demonstrate increased attention to healthcare workforce well-being. In 2017, the National Academy of Medicine (NAM) initiated a two-year Action Collaborative on Clinician Wellbeing (NAM, 2022). With over 200 organizations contributing, the initiative was renewed twice and remains ongoing. In May of 2022, the Office of the Surgeon General (OSG) issued an advisory on burnout among health workers (OSG, 2022). These national efforts demonstrate awareness that healthcare professionals' well-being must be a national priority to ensure the availability of safe patient care. Evidence to support this approach includes a study by Melnyk et al. (2018) in which acute care nurses' well-being was inversely related to medical errors and a systematic review that identified a negative correlation between nurse burnout and patient safety (Jun et al., 2021).

Wynendaele et al. (2019) identified 30 studies in a systematic review of the relationship between staffing and nurse outcomes. A strength of this review is the focus on quantitative studies; however, an important limitation is a heavy reliance on surveys. Using the same survey

to measure staffing and wellbeing risks bias, specifically *common method variance* in which respondents give answers that demonstrate consistency between their perceptions and experiences (Griffiths et al., 2016). Though further study is needed, the review concludes that implementing minimum ratios may improve retention and job satisfaction among nurses. This conclusion aligns with a similar systematic review by Twigg et al. (2021). Given high rates of intent to leave among acute care nurses before and during the COVID-19 pandemic (French et al., 2022; ANF, 2022) and the high cost of turnover (NSI, 2022), the proposed project will include nurse attrition as one of the outcomes participants will examine.

CHAPTER FOUR: METHODS

Methodology: The Delphi Policy Analysis

The rationale for selecting the Delphi policy analysis methodology is that the complexity of nurse staffing poses a significant challenge in understanding the impact of policy interventions. The business of health care co-exists with its mission of meeting human needs, and this creates conflicting perspectives on staffing decisions. In addition, randomization of patients and nurses to determine the impact of staffing policy on their outcomes is neither feasible nor ethical. As noted by Rayens and Hahn (2000), the iterative nature of the policy Delphi method provides insight to augment other data sources when empirical study is not possible.

Manley (2013) reports that the Delphi policy analysis can illuminate both intended and unintended consequences of a policy, if an appropriate process is applied to the selection of panel participants. Studies such as McHugh et al. (2021) demonstrate the impact of staffing policy on aggregate populations but do not provide insight on unintended consequences at the meso or micro levels of the socioecological framework. Nurse researchers have employed the Delphi technique to examine other divisive and complex issues such as the effect of twelve-hour shifts on nursing care (Keys, 2020), factors contributing to nursing errors (Roth et al., 2017) and global signature for nurse practitioners (Brown et al., 2021).

Procedures

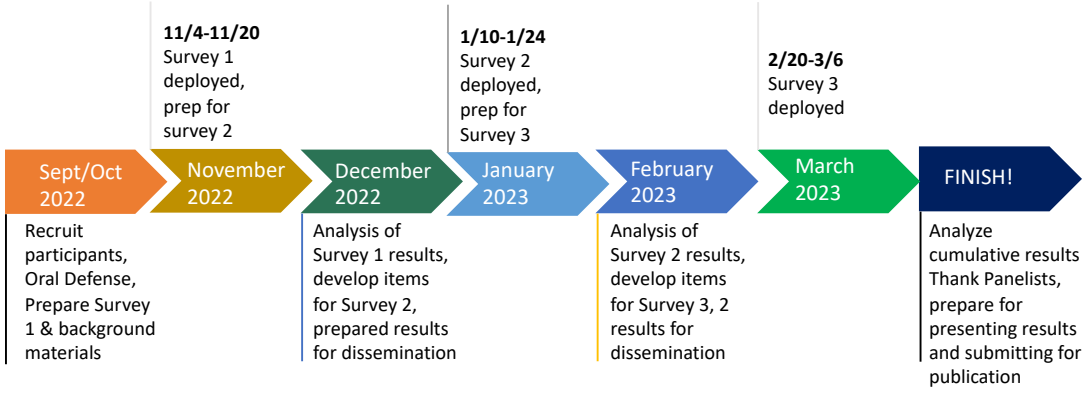
This Delphi policy analysis included three rounds of surveys sent by email as an online link to a panel of invited experts. Surveys were developed using Qualtrics® and data analysis was conducted in Microsoft Excel. Panel participants completed the surveys asynchronously in a previously established two-week interval for each round. Data analysis conducted after each round informed the composition of surveys in subsequent rounds. With the first survey, the panel

viewed a voice-over slide presentation explaining the project and synthesizing relevant literature. A written introduction to the project included a glossary of terms. These introductory materials explained how unit-level ratios are distinct from patient-level ratios, and established a shared language that might improve internal validity.

In alignment with the policy Delphi format, participants reviewed prior survey results before answering the subsequent rounds (Brown et al., 2021). As noted by Manley (2013), the policy Delphi process, unlike the traditional Delphi, does not seek to develop consensus but to explore the nuances of a policy-related issue. Including review of prior survey responses exposes participants to opposing views and encourages further articulation and consideration their own perspective (Brown et al., 2021). One panelist noted that this methodology created a "virtual dialogue" among the panelists.

Anonymity was preserved to encourage panel participants to provide candid responses. Survey data was shared in aggregate without identifying information. Email notification about the start of each round was sent individually to each panelist. This allowed for personalizing the messages and demonstration of the project lead's interest in each individual panelist's perspective. Reminder emails were sent using the blind carbon copy (bcc) feature of Google mail. Figure 4 provides the timeline for the Delphi policy analysis.

Figure 4: *Project Timeline*



Instruments

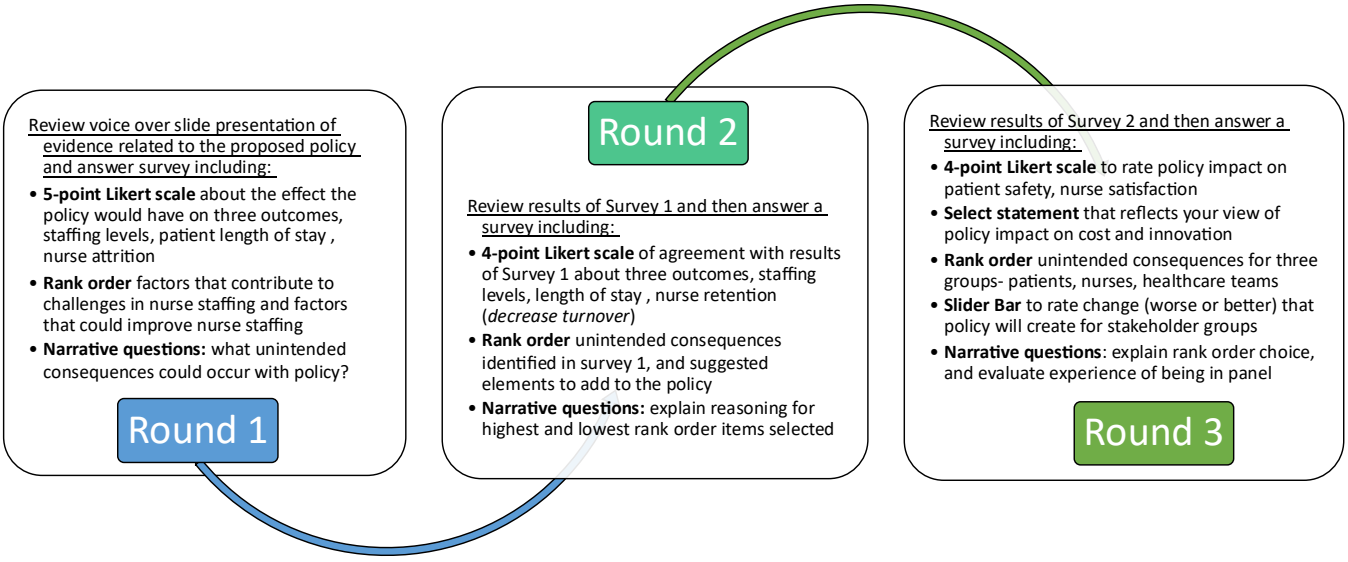
Three types of questions were used in all three surveys, Likert scale, rank order and open-ended. Quantitative analysis of Likert scale and rank order items was conducted after each round using Microsoft Excel. Items that showed a high level of agreement among panelists were not repeated. Items that showed significant differences were further addressed in subsequent rounds. This process aligns with the iterative nature of the Delphi Policy analysis (Brown et al., 2021). Appendix A provides the three surveys used in this project.

In the first survey, Likert scale items measured participant views on the impact of the policy on the identified outcomes: staffing levels, patient length of stay and nurse attrition. In Surveys 2 and 3, Likert scale items measured agreement with prior survey results and explored areas of discordance. The Likert items on the first survey included a neutral option while on survey 2, a four-point Likert scale encouraged articulation of a specific position.

The second type of question employed in all three surveys was rank order. In these items, participants used drag and drop to list a series of items based on their importance or likelihood. In the first survey, participants provided discreet rankings of the importance of factors that impact nurse staffing levels, and in a second rank order item, a discreet ranking of the perceived effectiveness of strategies to improve staffing. The second survey's rank order item was constructed from unintended consequences identified in the open-ended item on the first survey. Participants were asked to rank order item was the likelihood that those consequences would occur. In the third survey, the panelists again rank ordered consequences based on their likelihood. The third survey's rank order items included consequences that generated discordant replies in the second survey as well as new items identified in that survey's open-ended responses.

The third type of question used across all three rounds was open-ended, inviting qualitative data. In the first survey, open ended questions elicited potential unintended consequences. In the second survey, the panelists explained their choices in the rank order items. In the final survey, feedback about the Delphi process was requested. Figure 5 summarizes the project methodology and items used.

Figure 5: *Summary of three round Delphi Policy Analysis*



Population and Panel Selection

The project's efficacy in providing an analysis of the proposed policy depended on selecting a diverse panel of participants. Manley (2013) notes that Delphi policy methodology is more valuable when those with contrasting views are recruited. Thus, purposive sampling was used to recruit direct care nurses, nurse scientists, nurse managers, other health care leaders, and policy experts representing a wide range of experiences and perspectives on nurse staffing, from different parts of the United States, as the project was focused on the U.S. healthcare system. Exclusion criteria included an inability to complete the surveys in the identified timeframe and

lack of exposure to nurse staffing decisions and their outcome. Table 2 provides a summary of panelists characteristics.

Table 2: *Delphi Panelist Characteristics*

Panelist roles	Geographic diversity	Panelist employment
Direct care nurses in medical-surgical and intensive care units Chief executive officers Nurse educators Clinical nurse specialists Nurse scientist Nursing faculty Nurse managers Nurse directors Chief nursing officers	Northeast: New York, Connecticut, Massachusetts, Pennsylvania, New Jersey South: Alabama, Virginia, Tennessee, Washington DC, North Carolina Midwest: Ohio, Kansas, Wisconsin, Indiana, Illinois West and Southwest: Texas Washington, Colorado, California	Small and mid-size community hospitals: • Independent • System-owned • Rural, urban, suburban Large academic medical centers, public and private Health care leadership and consulting organizations Schools of nursing Nurse travel agency

Participant recruitment took place in fall of 2022. Each prospective panel member was provided with a synopsis of the project, the expected timeframe for each round, and link to enroll in the project. Upon consenting to join the panel, participants were asked to commit to responding to all three rounds. The opportunity to discuss the project via a synchronous video conferencing platform, Zoom™ was offered to all participants, and this invitation was accepted by two participants.

Brown et al. (2021) notes that a policy Delphi panel can range in size from 10 to 59 while Raynes and Hahn (2000) describe the typical size as 10 to 30. Essentially, the sample size must be large enough to represent a variety of views and experiences (Manley, 2013) and small enough to ensure a manageable data set given the project's time constraints. For this project, a panel of 28 participants were enrolled.

Ethical Considerations

This Delphi policy analysis was exempt from review by the Institutional Review Board (IRB) because the human subjects will be answering surveys anonymously and the information they provide will not be connected to their identity. These characteristics meet exemption status as described by the University of California, Los Angeles (UCLA) Research Administration (UCLA, 2022). The chair of the project committee and the director of the Doctor of Nursing Practice program were consulted and concur that the project will not require IRB approval at UCLA (Personal communications, August 2022).

While IRB review is a key consideration, the ethics of conducting research extend beyond the need for formal approval. The project lead acknowledged an ethical obligation to protect the members of the participant panel from harm. Before accepting the invitation to join the project, participants were provided with information about potential concerns, including coercion, discomfort with answering the questions, and the risk of their views being connected to their personal identity. The Google form completed by panelists at the time of enrollment explained that participation is voluntary, questions can be left unanswered if discomfort occurs, and anonymity will be maintained. In addition, the participants were given the choice of being acknowledged in the dissemination of the results or remaining anonymous.

Setting

The American Association of Critical-Care Nurses provided a setting for the project. The organization's strategic plan identifies staffing as a priority advocacy issue and demonstrates this through an interprofessional partnership with other organizations (AACN, n.d.) and the development of resources to support appropriate staffing. Historically, the organization has not supported policies that enforce minimum nurse-to-patient ratios. However, the organization is

also committed to endorsing evidence-informed positions (AACN, 2020). In addition, the organization's adherence to healthy work environment standards offered support for the project. The clinical preceptor values authentic leadership and offered consistent support. Externally, the need for structural changes within the healthcare system, highlighted by the COVID-19 pandemic, made the project a well-timed endeavor.

An additional setting is the virtual space where the project leader interacted with the participant panel. To reduce the risk of attrition and increase internal validity, the project lead offered individual interactions by phone or email to address questions and concerns. All communications with the panel were crafted to demonstrate respect for different perspectives and a sense of inclusion. For example, the Delphi policy analysis, was referred to as "our project" and the voice-over-slide background material described the goal of the project as "our aim".

Data Collection and Analysis

The project plan identified the two-week interval in which surveys were deployed, and panel members were given these dates when invited to join the project (see Figure 4). The project plan included a one-week grace period to increase survey response rate. Individual emails notified participants of the launch of each round and email reminders were sent one week after deployment and three days before closing the survey.

Surveys were conducted online using Qualtrics and data analysis was conducted in Microsoft Excel. Quantitative analysis of Likert scale and rank order items involved assigning numeric values and calculating mean, mode, range, quartiles, and standard deviations. Levels of agreement were measured by calculating the interquartile deviation (IQD), the difference between the absolute value of the 75^{th} quartile and the absolute value of the 25^{th} quartile. Smaller IQD scores indicate higher levels of agreement (Rayens and Hahn, 2000).

In the cumulative analysis after round 3, the mean deviation from the median (MDM) was calculated for rank order items in surveys 2 and 3. The MDM was added after consultation with the UCLA School of Nursing statistics support and contributed to assessment of agreement among panelists. While the IQD is a standard measure of agreement in Delphi methodology (Rayens and Hahn, 2000), the MDM provides additional insight as it is inclusive of outlier responses.

For all three surveys, a content analysis approach was used for responses generated through open-ended survey questions (Lindgren et al., 2020). Using content analysis, those open-ended responses were placed in categories representative of similar content, such as staffing consequences that pertained to specific stakeholder groups, and descriptive analysis to inform item development in subsequent surveys. An interpretative analysis of content categories was used to examine convergent and divergent views related to cost, innovation, and nurse engagement in staffing decisions (Lindgren et al., 2020). Summaries of data aggregated into content categories were de-identified and shared first with the project committee and then with the panel participants. The exact transcript of each summary sent to the panelists is provided in appendices B, C, and D. All data were stored on a password-protected personal computer hard drive.

CHAPTER FIVE: RESULTS

The response rate in the first survey was 75% (21 of 28 panelists) and for surveys 2 and 3 the response rate was 78.6% (22 of 28 panelists). Respondents did not provide identifying information in the surveys, as anonymity is a key characteristic of the policy Delphi (Brown et al., 2021). To ensure the survey responses were inclusive of different roles, the panelists were asked to indicate the percentage of professional time they spend in direct patient care. Table 3 shows those results.

Table 3: *Respondents time spent in direct patient care*

Survey	0% of time in direct care	Less than 50% in direct patient care	Greater than 50% in direct patient care
1	9 (42.9)	5 (23.8)	7 (33.3)
2	8 (36.4)	7 (31.8)	7 (31.8)
3	7 (31.8)	9 (40.9)	6 (27.3)

Note. Numbers represent number of panelists (percentage based on total responses). Percentages may not add to 100 due to rounding.

Survey 1

In survey 1, panelists answered 5-point Likert scale items about the effect of the proposed unit level ratio policy on the three outcomes, staffing levels, patient LOS, and nurse attrition. The full results are listed in Table 4. For analysis, numeric values of 1 to 5 were assigned, so that lower numbers indicated negative effects (lower staffing levels, longer patient LOS, and increased nurse attrition) and higher numbers indicated positive effects (higher staffing levels, shorter LOS, and decreased nurse attrition). A score of 3 was assigned to the neutral item, indicating the policy would not affect the outcome.

The mean scores and IQD indicate moderate agreement among the panel that the proposed policy could result in a small positive effect, increasing staffing (mean= 4.19, IQD=1) and decreasing patient LOS (mean= 4.24, IQD=1). The mean score for the question on attrition (4.05) indicates a small positive effect but the IQD of 2 shows was less agreement among the panelists about that effect.

Table 4: *Survey 1: Likert scale items*

Rating of potential effects of the proposed policy

	Large/significant negative effect	Small negative effect	No effect	Small positive effect	Large/significant positive effect
Increase staffing levels	0	0	3 (14.3)	11 (52.4)	7 (33.3)
Shorter patient LOS	0	0	3 (14.3)	10 (52.4)	8 (38.1)
Decrease nurse attrition	1(4.8)	0	5 (23.8)	6 (28.6)	9 (42.8)

Note. Numbers represent responses (percentage based on total responses). Percentages may not add to 100 due to rounding.

Survey 1 included two rank order items. The first asked panelists to rank the importance of ten factors that contribute to inappropriate nurse staffing in medical-surgical settings. Table 5 provides the mean, mode, and IQD for the panelists' responses. Higher mean and mode indicate greater importance while higher IQD indicates lower levels of agreement. The second rank order asked panelists to rate the efficacy of ten different strategies that could improve nurse staffing. Higher mean and mode indicate greater perceived efficacy. Table 6 shows those results.

Table 5: *Survey 1 Rank order*

Importance of factors that contribute to inappropriate nurse staffing

Factor affecting staffing	Importance		Agreement
	Mode	*Mean*	*IQD*
Organizations work environment is unhealthy	2	4.95	5.25
Not enough nurses graduating from nursing schools	1	5.25	7
Nurses are leaving for travel nurse positions	9	6.65	4
Hospital hiring processes are slow	5	4.95	3
Units do not have enough preceptors to orient new nurses	8	6.05	4
Decisions @ staffing do not include direct care nurses	6	6.1	3.25
Hospitals offer limited opportunities for career advancement	4	4.55	3
Direct care nursing is not a long-term job	4	5.5	5
The unit work environment is unhealthy	1	5.95	6.25
Nurse managers lack support, training for their workload	8	5.05	4.25

Note. Higher score indicates greater importance. IQD of 3 or above indicates low agreement.

Table 6: *Survey 1 Rank order*

Effectiveness of actions to improve nurse staffing

Strategy to improve staffing	Effectiveness		Agreement
	Mode	*Mean*	*IQD*
Increase compensation (salary and benefits)	10	6.4	7
Create options for flexible scheduling	8	5.85	4.25
Provide support for child/older adult care	1	3.15	4
Offer opportunities for remote work opportunities	6	4.5	4
Invest in creating/testing new models for providing care	2	5.9	6
Create shared governance to involve nurses in decisions	6	5.6	3.5
Provide onsite resources to support emotional well-being	4	5.25	3.25
Build processes for recognizing the contributes of nurses	4	5.95	3.25
Prevent bullying and workplace violence	**9**	**6.65**	**2.5**
Invest in ancillary staff to support work at top of license	8	6.75	5.25

Note. Higher score indicates greater importance. IQD of 3 or above indicates low agreement.

The one area of high agreement across both rank order questions was that *preventing bullying and workplace violence* would be effective in improving staffing. There was modest agreement that *hospital hiring processes* and *limited opportunities for career advancement* were less important factors in contributing to inappropriate staffing. For all other items, the IQD score greater than 3 indicates low agreement. An open-ended item on Survey 1 asked panelists to list anticipated unintended consequences that the proposed policy could create. This list was used to develop a rank order item on Survey 2.

Survey 2

Panelists were asked to review Survey 1 results before completing Survey 2. Appendix B is the summary they received. Likert scale items on survey 2 asked panelists to rate their agreement with the survey 1 results related to the small positive effect of the policy on nurse staffing levels, patient LOS, and nurse attrition. There was no neutral option. The numeric scale assigned for analysis was from 1 (strongly disagree) to 4 (strongly agree). The mean results and IQD scores for staffing levels (mean= 3.27, IQD=1), patient LOS (mean=2.95, IQD=0) and nurse attrition (mean=3.14, IQD=1) suggest moderate agreement. Table 7 lists the full results.

Table 7: *Survey 2 Likert scale items*

Agreement with survey 1 results

	Strongly disagree	***Somewhat disagree***	***Somewhat agree***	***Strongly agree***
Increase staffing levels	1 (4.5)	1 (4.5)	11 (50)	9 (40.1)
Reduce patient length of stay	2 (9.1)	2 (9.1)	13 (59.1)	5 (22.7)
Increase nurse retention/ reduce turnover	1 (4.5)	2 (9.1)	12 (54.4)	7 (31.8)

Responses (percentage based on total responses). Percentages may not add to 100 due to rounding.

Responses in Survey 1 to the prompt "*The intent of a minimum unit level nurse-to-patient ratio policy is to improve patient outcomes by increasing staffing levels. Please list 3 or more unintended consequences of this policy. These could be positive or negative consequences outside the intended effect.*" were used to create a rank order item of unintended policy consequences in Survey 2. The results including the mean and mode, indicating perceived likelihood and the IQD and MDM indicating level of agreement, are listed in Table 8. There was a high level of agreement that the proposed policy was unlikely to *decrease attention to other workplace issues* and moderately likely to *create inequity for nurses*. There was moderate agreement that the policy was highly likely to *decrease staffing in units staffing above the minimum*, moderately likely to create *inequity for patients* and not likely to *decrease care delivery innovation*. For all other consequences, panelists indicated differing views.

Table 8: *Survey 2 Rank order of Unintended Consequences*

Unintended Consequence	Likelihood		Agreement	
	Mode	*Mean*	*IQD*	*MDM*
Decrease hiring of support staff	3	5.05	**4**	**2.14**
Reduce attention to other workplace issues	4	4.82	2.75	1.91
Increase costs for healthcare payers	1	4.82	**5.5**	**2.55**
Increase risk of hospital closures	1	4.27	**5**	**2.72**
Decrease staffing in units that currently staff above the minimum	**8**	**6.91**	3	1.63
Create inequity for patients	5	5.27	3	1.73
Create inequity for nurses	**6**	**6.09**	2.75	1.73
Increase nurses' job satisfaction	**9**	**6.86**	**4.75**	**2.5**
Increase patient safety	**10**	**7.55**	**4**	**2.18**
Decrease innovation in care delivery	1	3.36	3	2

Note. Discreet rank order from 1- 10, with higher score indicating greater likelihood. IQD < 3 indicates high agreement, 3-4 indicates moderate agreement, ≥ 4 indicates low agreement.

Open-ended items on survey 2 asked panelists to explain their rank order. The purpose of this was twofold. First, this question elicited additional information about unintended consequences of the policy. Second, asking for explanations provided confirmation regarding panelist's interpretation of the rank order. Because the first survey had widely disparate replies, the project lead sought to ensure correct interpretation of 1 as the lowest ranking and 10 as the highest ranking.

The open-ended responses on Survey 2 demonstrated striking differences regarding two consequences, care delivery innovation and health care costs. Despite the low IQD indicating moderate agreement, comments revealed opposing expectations about the policy's effect on innovation in care delivery. Some panelists believed the policy would give nurses more time to engage in innovation, while others expected the policy to stifle motivation to innovate. An additional nuance in the qualitative data was differentiation between long- and short-term health care costs. Items on Survey 3 further explored these areas.

Survey 3

Panelists were sent the Survey 2 results with the link to Survey 3 (see Appendix C for the summary they received). Two areas of discord on Survey 2 involved the policy's impact on patient safety (IQD=4) and nurse satisfaction (IQD=4.75). As a result, Likert scale items on survey 3 explored those consequences further, using a four-point scale without a neutral option. In this round, panelists demonstrated agreement that the policy would improve patient safety (mean=3.41, IQD=1) and improve nurse satisfaction (mean 3.41, IQD=1).

Another Likert item sought further insight from panelists about short- and long-term costs. None of the panelists anticipated the policy would lead to a decrease in short-term costs.

One panelist selected the neutral item indicating no impact on costs. Views on long-term costs varied. Panelists were also asked to clarify their view of the policy's impact on care delivery innovation in a four-point Likert item. While the mean (2.95) and IQD (0) for this item suggest agreement that the policy would result in somewhat more innovation, five panelists expressed the view that innovation would decrease with policy implementation. The item responses are listed in Table 9.

Table 9: *Survey 3 Likert scale items*

Improve patient safety	*Strongly disagree*	*Somewhat disagree*	*Somewhat agree*	*Strongly agree*
	0 (0)	**1 (4.6)**	**11 (50.0)**	**10 (45.5)**
Improve nurses' job satisfaction	*Strongly disagree*	*Somewhat disagree*	*Somewhat agree*	*Strongly agree*
	0 (0)	**0 (0)**	**13 (59.1)**	**9 (40.9)**
Increase/decrease short- and/or long-term cost	*Increase costs, both short and long term*	*Increase costs in the short term, and decrease costs in the long term*	*No impact on cost*	*Decrease costs in short- term costs (increase/decrease long-term)*
	7 (31.8)	**14 (63.6)**	**1 (4.6)**	**0 (0)**
Increase or decrease innovation	*Much less innovation*	*Somewhat less innovation*	*Somewhat more innovation*	*Much more innovation*
	1 (4.6)	**4 (18.2)**	**12 (54.6)**	**5 (22.7)**

Note. Numbers represent number of panelists (percentage based on total responses). Percentages may not add to 100 due to rounding.

In survey 3, the rank order of unintended consequences was divided into three items based on the stakeholder group, patients, nurses, and other healthcare team members. This allowed for the rank order items to be 1 through 5 instead of 1 through 10 which optimized viewing on mobile devices. In addition, the use of three separate rank order items allowed

greater precision in measuring panelist views of the likelihood these consequences would occur.

Table 10 lists the mean, mode, IQD, and MDM for the three rank order items.

Table 10: *Survey 3 Rank Order results by stakeholder*

Likelihood of Unintended Consequences occurring

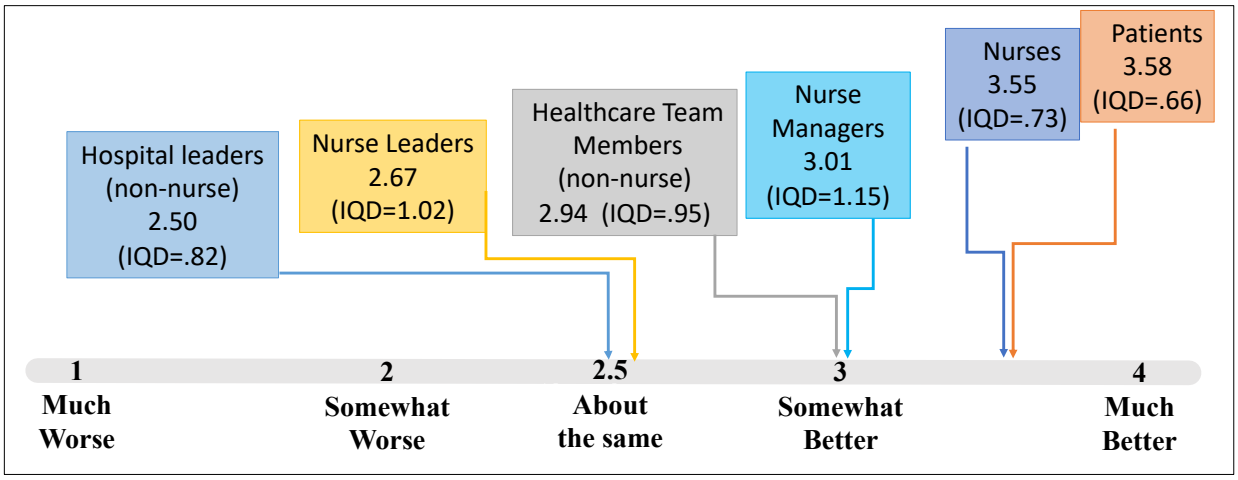
Survey item	**Likelihood**		**Agreement**	
Consequences for Patients	*Mean*	*Mode*	*IQD*	*MDM*
Increase quality of care	**4.32**	**5**	1	.68
Increase patient satisfaction	**3.64**	**4**	1	.82
Decrease errors and missed care	**3.59**	**3**	1	.77
Delay elective procedures	1.91	2	1	.55
Decrease access to care	1.55	1	1	.55
Consequences for Healthcare Teams	*Mean*	*Mode*	*IQD*	*MDM*
Increase use travel or agency nurses	**4.14**	**5**	**1.75**	.77
Decrease hiring of support staff	**3.86**	**4**	**1.75**	.68
Decrease dialogue @ staffing decisions	**3.41**	**4**	1	**1.05**
Create worse work environment	1.91	2	1	.64
Cause hospitals to close	1.68	1	1	.68
Consequences for Nurses	*Mean*	*Mode*	*IQD*	*MDM*
Increase time with patients	**4.14**	**5**	**1.75**	**.86**
Decrease burnout	**3.59**	**4**	**1.75**	**.95**
Increase floating to unfamiliar units	2.73	3	1	.82
Increase mandatory overtime	2.41	1	**2.75**	**1.05**
Less involvement in staffing decisions	2.14	1	**2**	**.86**

Note Higher mean and mode= greater likelihood; higher IQD and MDM = low agreement.

A slider bar item on survey 3 asked panelists to rate the change the proposed policy might create for different groups (see Figure 6). The rating was on a scale from 1 (much worse) to 4 (much better), and 2.5 was a neutral option. The low IQDs indicate agreement that the policy would lead to better circumstances for nurses and patients and have a less effect on leaders.

Figure 6 *Slider bar items*

Rating the type of change the policy would introduce for different groups



Note: Numbers in each box provide the mean score and (IQD)

The final items on Survey 3 elicited panelists' satisfaction with their role in the project and the efficacy of the Delphi Policy analysis process. These results are listed in table 11. All panelists were somewhat or extremely satisfied with their role and all felt that the process was at least moderately effective.

Table 11: *Project evaluation*

Item	Mean	Mode	IQD
Satisfaction with panelist role (*1= extremely dissatisfied, 3= neutral, 5= extremely satisfied*)	4.82	5	0
View of project effectiveness (*1=not at all effective, 3= moderately effective, 5= extremely effective*)	4.05	4	2

CHAPTER SIX: DISCUSSION

Existing evidence shows a correlation between ratio-based staffing policy and staffing levels (Han et al., 2021) and nurse intent to leave (Wynendaele et al., 2019). In addition, a systematic review of longitudinal studies finds that staffing levels are correlated to patient LOS (Dall'Ora et al., 2022). In this project, responses on surveys 1 and 2 show moderate agreement that the policy would increase staffing levels, decrease patient LOS, and reduce nurse attrition. However, the panelists did not reach uniform consensus on those outcomes. Differences in their views may be related to different expectations about other consequences of the policy.

While rank ordering on survey 2 elicited differing views about the magnitude of impact on patient safety and nurse satisfaction, the Likert items on survey 3 showed high agreement that these consequences were likely. In addition, the slider bar item on survey 3 showed high agreement among a diverse panel that the change the policy would introduce would be better for nurses and patients, though neutral for those in healthcare leadership. Thus, a conclusion from this project is that panelists anticipate the proposed policy would be of benefit to both patients and nurses.

Content analysis of the qualitative data provided by the panelists demonstrates that the policy alone will not adequately address the breadth of the nurse staffing crisis. Comments including those that described existing poor collaboration between hospital leaders and direct care staff, the potential for bullying by clinical leaders, and a perception that the business of healthcare is prioritized over the needs of patients demonstrate that micro-level interventions to address the work environment are imperative. These findings are consistent with a meta-analysis which concluded that the overall health of the work environment and nurse staffing are inextricably linked (Lake et al., 2019). While robust literature shows that the number of nurses is

correlated to patient outcomes, other elements of the work environment also affect care delivery. The policy sets unit-level ratios, offering flexibility in patient assignments, which makes authentic leadership among clinical leaders vital to the equitable allocation of nursing resources.

Unintended Consequences of the Proposed Policy

Examination of unintended consequences is the unique contribution of this project's design. Every policy implementation must include consideration of unintended consequences (Manley, 2013). In survey 2, the panelists agreed that a decrease in staffing in units above the policy minimum was a likely outcome of the proposed policy. The risk in establishing minimum staffing levels is that patient care situations that require staffing levels above that minimum are inadequately addressed. In a study of intensive care unit staffing, Jansson et al. (2020) retrospectively analyzed staffing deficits and noted that measurement based on nurse-to-patient ratio identified fewer periods of low staffing than an assessment based on nursing workload. Because understaffing is a potential unintended consequence of minimum ratio policy, any policy that seeks to improve nurse staffing by setting ratios must include a requirement for upward adjustment in response to changes in patient care demands.

Other unintended consequences identified by the panelists in this study relate to strategies for meeting the policy requirement. Increased use of travel nurses was identified as a likely outcome. A large retrospective analysis found statistically significant lower rates of inpatient mortality associated with higher levels of permanent nursing staff, but that correlation did not hold true for contingent staff (Zaranko et al., 2023). Further research is needed regarding the impact of employing travel nurses.

Decreased support staff to redirect budgets to licensed nurses was another consequence that panelists identified. In their analysis of AHA data, Han et al (2021) found the opposite

consequence; UAP staffing was higher in California with a ratio policy even though the policy only related to licensed staff. In addition, evidence related to skill mix indicates that improvements in patient outcomes may result when the proportion of care provided by licensed staff is higher (Martsolf et al., 2014). While further analysis is needed, it is not clear that decreasing the ratio of unlicensed to licensed staff would be an explicitly negative consequence.

Articles that reflect expert opinion cite a decrease in innovation (Bradley, 2023), increase in costs (Kerfoot & Buerhaus, 2022) and disengagement of nurses from staffing decisions (Bartholomew, 2023) as unintended consequences of policies that set minimum staffing ratios. These outcomes could adversely affect patient care and the nursing profession. In this analysis, panelists indicated divergent views of those outcomes and each warrants further consideration.

Innovation

Panelists' responses to open-ended items demonstrate that different expectations related to the policy's impact on care delivery innovation may relate to differing views of how innovation occurs. Those who interpreted direct care nurses as the ones driving innovation anticipated an increase with the policy because higher staffing levels would allow more time to innovate. Those who interpreted hospital leadership as the drivers of innovation expected the policy to stifle innovation. Some experts note that care delivery innovation is imperative, as the volume of nurses cannot adequately meet the demand for care in our aging society with continued reliance on a primary nursing model (Safavi & O'Neal, 2023).). Effective innovation will require engagement of both direct care nurses and the leaders that support them and thus, further exploration of how ratio-based policies effect innovation is warranted.

Cost

The panelists were nearly unanimous in anticipating an increase in short term costs with policy implementation. Open-ended responses explained differing views about the long-term cost. Some expected ongoing high costs due to increased salary expenditures, while others anticipated improved patient outcomes with higher staffing would result in cost avoidance. In McHugh et al.'s (2021) analysis of Australian ratio policy, the cost of increased staffing was more than covered by the cost avoidance in shorter patient LOS. Other analyses find that cost savings from shorter LOS covers most but, not all, of the cost of improved staffing (Dall, 2009).

Long-term cost avoidance is a key consideration and one that may not influence daily financial decisions in hospitals. As Dall (2009) notes, the absence of a financial incentive for appropriate nurse staffing represents a failure of the health care finance structure to align with the best interests of society. This project identifies patients as a discreet stakeholder in staffing decisions, though in fact, all members of society exist as potential patients, unwittingly reliant on acute care services to address a serious illness or injury. Further analysis is needed to explore opportunities to change the existing structure and align financial incentive with societal best interests.

Engaging nurses in staffing decisions

Panelists' views of the policy's impact on nurses' engagement in staffing decisions warrants discussion. On survey 3, the item was phrased as *less involvement in staffing decisions* which pre-supposes that there is existing involvement, Ulrich et al (2022) reporting the results of a 2021 work environment survey, noted that acute and critical care nurses gave low ratings related to their engagement in decisions that affect feel work. Thus, the discordant responses for

this item may reflect the current state of mixed engagement in decision-making rather than a perception related to the policy's outcome.

A key barrier to nurse engagement in administrative decisions is the volume of their clinical work and their ethical obligation to prioritize patient care (American Nurses Association, 2015). These factors generate a logistical barrier to leaving a hospital unit to attend meetings or contribute to committees. Direct care nurses who experience that barrier may anticipate an increased involvement in decisions with a ratio-based policy that increases staffing levels and offers more coverage for clinical responsibilities. Such a perception would explain the mixed ratings for the likelihood that the policy would decrease nurse engagement in staffing decisions.

Project Implications

The most important implication of this project is that Delphi policy analysis with accompanying qualitative data collection offers an effective strategy for examining the divisive topic of nurse staffing ratio policy. Based on responses in survey 3, the members of the panel experienced satisfaction with their role and found the process effective. Next steps for this work include repeating the analysis over a longer timeframe with a larger panel. In addition, further study of the impact of ratio-based staffing policy is needed. While retrospective analysis of unintended consequences will have limitations, combining different methodologies creates a more comprehensive understanding of the complexity of policy outcomes.

The results of this project may be eligible for dissemination via publication in a nursing journal. Such dissemination would share the findings and demonstrate the application of the Delphi policy analysis process. An advantage of this methodology is the inclusion of opposing points of view to create a broader understanding of policy outcomes. In some forums, ratio policy generates polarized positions which negatively impact dialogue. The elements of

anonymity and asynchronous responses in the Delphi process create a space for honest contributions without the emotional tone that occurs in live interactions.

An additional implication is the expansion of the analysis to examine other forms of staffing policy and other clinical settings. A further project could include comparing minimum ratios to other policy interventions such as required staffing committees, mandated public reporting of staffing levels, incentives to use acuity-based staffing tools, or adjustments in the reimbursement of hospital care so that the financial value of nursing is quantifiable. Because of resource limitations and time constraints, this project focuses exclusively on adult medical-surgical units in acute care hospitals. However, nurse staffing is a challenge across all sectors of the health care system, including long-term care, public health and school nursing, and other acute care specialties, such as pediatrics, emergency departments, and critical care. Such settings also warrant examination of the impact policy interventions will have.

Project limitations

Because this project did not include policy implementation, the results do not measure its impact, unintended consequences, or stakeholder satisfaction. Additional limitations were the small number of participants and the use of only three rounds to fit the time constraints of the Doctor of Nursing Practice program. The data analyzed in this project offers a very small contribution amid other sources of evidence to inform advocacy for nurse staffing policies. Evaluation of a cumulative body of data collected through diverse methods is the ideal strategy for evidence-informed advocacy.

CONCLUSION

This project demonstrates that unit-level nurse-to-patient ratio policy could offer benefits for nurses and patients. Such a policy will also have unintended consequences and will not solve

the full scope of challenges we face in acute care staffing. Inclusion of direct-care nurses and healthcare leaders in policy development is crucial to identifying and mitigating the unintended consequences that staffing policy will generate. This project also demonstrates that the Delphi policy analysis process is an effective tool for studying the divisive topic of staffing policy.

APPENDICES

Appendix A: Surveys used in Rounds 1, 2, and 3

SURVEY 1 (October/November 2022)

Please indicate the percent of your professional time that you spend providing patient care.

- 0% of my time
- 0-50% of my time
- 50% or more of my time

If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what effect would you expect to see on current staffing levels?

- A large negative effect (staffing levels would significantly decline)
- A small negative effect (staffing levels would decline but not by much)
- No effect (staffing would stay the same)
- A small positive effect (staffing levels would increase but not by much)
- A large positive effect (staffing levels would significantly increase)

If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what impact would you expect to see on patient length of stay (LOS)?

- Negative impact (LOS will increase by a significant amount)
- Slight negative impact (LOS will increase but not significantly)
- No Impact (LOS will stay the same)
- Slight impact (LOS will decrease but not significantly)
- Positive impact (LOS will decrease to by a significant amount)

If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what impact would you expect to see on nurse attrition?

- Increased nurse attrition (a significant increase in nurse turnover)
- A small increase in nurse attrition (nurse turnover would go up but not by much)
- No change in nurse attrition (nurses would continue to leave at the same rate)
- A small decrease in nurse attrition (nurse turnover would go down but not by much)
- Decreased nurse attrition (a significant decrease in nurse turnover)

The factors listed below can contribute to inappropriate nurse staffing. Please rank the impact these factors have. 1= the least impact and 10= the most impact.

- The organization's work environment is unhealthy
- There are not enough nurses graduating from nursing schools
- Nurses are leaving for travel nurse/ contingency positions
- Hospital hiring processes are slow
- Units do not have enough preceptors to orient new nurses
- Decisions about staffing do not include input from direct care nurses
- Hospitals offer limited opportunities for nurses' career advancement
- Direct care nursing is not a long-term job
- The unit work environment is unhealthy
- Nurse managers lack support, training for the workload they manage

The actions listed below can improve nurse staffing. Please rank how effective you think these actions might be. 1= the least effective and 10= the most effective.

- Increase compensation (salary and benefits)
- Create options for flexible scheduling
- Provide support for childcare/older adult care
- Offer opportunities for remote work/tele-health
- Invest in creating/testing new models for providing care
- Create shared governance and other structures for involving nurses' decisions
- Provide onsite resources to support emotional wellbeing
- Build processes for recognizing the contributions of nurses
- Prevent bullying and workplace violence
- Invest in ancillary staff to support nurses working at top of license

The intent of a minimum unit level nurse-to-patient ratio policy is to improve patient outcomes by increasing staffing levels. Please list 3 or more unintended consequences of this policy. These could be positive or negative consequences outside the intended effect.

In the video accompanying this survey, I reviewed a small portion of the literature on nurse staffing. Are there other studies or articles that inform your view of this topic? Please list below! (This question is optional)

If there are factors that affect nurse staffing or strategies to improve nurse staffing that are not listed in Questions 5 and 6, please add them here. (This question is optional)

SURVEY 2 (January 2022)

Q1. Please indicate the percent of your professional time that you spend providing patient care.

- 0% of my time
- 0-49% of my time
- 50% or more of my time professional

Q2. Results from Survey 1 showed consensus that a minimum unit level nurse-to-patient ratio policy could increase staffing levels. Please indicate your level of agreement with that result.

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

Q3. Results from Survey 1 showed consensus that a minimum unit level nurse-to-patient ratio policy could reduce patient length of stay. Please indicate your level of agreement with that result.

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

Q4. Results from Survey 1 indicate that some panelists believe that a unit level minimum nurse-to-patient ratio policy would increase nurse retention (reduce turnover). Please rate your level of agreement with that effect.

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

Q5. Below are unintended consequences (both positive and negative) of the policy from the Survey 1 results. Please use drag and drop to rank order the likelihood of these consequences occurring. 1= LEAST LIKELY and 10= MOST LIKELY

- Decreases hiring of ancillary staff/support staff who work with nurses
- Reduces attention to other workplace issues
- Increases costs for health care payers
- Increases risk of hospital closures
- Decreases staffing in units that currently staff above policy minimum
- Creates inequity for patients (because nurse to patient ratio can vary)
- Creates inequity for nurses (because nurse to patient ratio can vary)
- Increases nurses' job satisfaction
- Increases patient safety
- Decreases innovation in care delivery

Q6. Please use the space below to describe your reasoning for the highest and lowest rankings in Question 5 about unintended policy consequences.

Q7. As noted in the results from survey 1, the policy does not include factors that affect implementation. Please use drag and drop to rank order the importance of adding the following elements to the policy. 1 = LEAST important and 5 = MOST important

- Measurement of patient acuity
- Measurement of nurse competency
- Accurate accounting of patient volume (overflow, hallway beds)
- Measurement of the health of the work environment
- Evaluation of the policy impact on patient outcomes

Q8. Use the space below to describe the reasoning for your highest and lowest ratings in Question 7, about elements to add to the policy.

Q9. The proposed policy, unit level nurse-to-patient minimum ratios in medical surgical settings, creates change for multiple stakeholders. Use the slider bars below to rate how implementing this policy could change the current state for the following groups:
1 = a change for the worse and 4 = a change for the better.

- patients
- nurses
- nurse managers
- non-nurse members of the health care team
- nurses in leadership positions (CNO)
- hospital leaders who are not nurses (i.e., CMO, CFO)
- payers (insurers, Medicare, Medicaid)

Q10. Use the space below to describe the reasoning for your ratings in question 9, about the change this policy would create for different stakeholders.

OPTIONAL Q11. Please use the space below if you have additional comments on the survey 1 results. (OPTIONAL- This is the final question in this survey)

SURVEY 3 (February/March 2023)

Please indicate the percent of your professional time that you spend providing patient care.

- 0% of my time
- 1-49% of my time
- 50% or more of my time

Please rate your level of agreement that establishing a unit-level minimum nurse-to-patient ratio would improve ***patient safety.***

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

Please rate your level of agreement that establishing a unit-level minimum nurse-to-patient ratio would improve ***nurses' job satisfaction.***

- Strongly disagree
- Somewhat disagree
- Somewhat agree
- Strongly agree

In survey 2, some panelists noted that the policy's affect on ***cost might be different in the short and long term***. Please select the option below that reflects your view.

- The policy will increase costs, both short and long term
- The policy will increase costs in the short term, and decrease costs in the long term
- The policy will have no impact on cost, short or long term
- The policy will decrease costs in the short term and increase costs in the long term
- The policy will decrease costs, both short and long term

Comments on Survey 2 revealed different opinions regarding the minimum unit-level nurse-to-patient ratio policy's affect on ***innovation in care delivery***. In your view, implementation of this policy will lead to:

- Much less innovation
- Somewhat less innovation
- Somewhat more innovation
- Much more innovation

In Survey 2, we identified that the policy could have both **negative and positive** consequences for *PATIENTS.* Please drag and drop the following statements **from LEAST likely to occur to MOST likely to occur.** (1=least likely, 5=most likely)

- DECREASE access to care
- INCREASE quality of care
- DELAY elective procedures
- INCREASE patient satisfaction
- DECREASE in errors and missed care

In the space below, explain your choice for the **MOST likely to occur consequence** for patients **(#5 in your list above).**

In survey 2, we identified that the policy could have **negative and positive** consequences for *NURSES*. Please drag and drop the following statements **from LEAST likely to occur to MOST likely to occur.** (1=least likely, 5=most likely)

- INCREASE mandatory overtime
- INCREASE time with patients
- DECREASE involvement in staffing decisions
- DECREASE burnout
- INCREASE floating to unfamiliar units

In the space below, explain your choice for the **MOST likely to occur consequence** for nurses (**#5 in your list above**).

In Surveys 1 and 2, we identified unintended consequences that the policy could have on *HEALTH CARE TEAMS***.** Please drag and drop the following statements **from LEAST likely to occur to MOST likely to occur.** (1=least likely, 5=most likely)

- Make for a worse work environment
- Increase the use of agency/travel nurses
- Reduce dialogue about staffing decisions
- Cause hospitals to close
- Decrease hiring of ancillary/support staff

In the space below, explain your choice for the **MOST likely to occur consequence** for health care teams (**#5 in your list above**).

The proposed policy, unit level nurse-to-patient minimum ratios in medical surgical settings, creates change for multiple stakeholders. Use the slider bars below to rate how implementing this policy could change the current state for the following groups: **1 = a change for the worse and 4 = a change for the better.**

- Nurses
- Patients and families
- Nurse Managers
- Non-nurse care team members
- Nurse Leaders (CNOs)
- Non-nurse hospital leaders

Please rate your level of satisfaction with the experience of being a panelist in this project.

- Extremely dissatisfied
- Somewhat dissatisfied
- Neither satisfied nor dissatisfied
- Somewhat satisfied
- Extremely satisfied

Please rate the effectiveness of the Delphi Policy methodology in analyzing a nurse staffing ratio policy.

- Not effective at all
- Slightly effective
- Moderately effective
- Very effective
- Extremely effective

OPTIONAL Use the space below if you have additional thoughts on the Survey 2 results or feedback on the project as a whole. I am very grateful for the time you gave to this work!

Appendix B: Summary of Survey 1 Results (This is the exact transcript sent to panelists)

Question 1: Indicate the percentage of professional time you spend providing patient care

9 respondents spend 0% of their time providing patient care

5 respondents spend 0-50% of their time in providing patient care

7 respondents spend 50% or more of their time providing patient care

Question 2: *If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what effect would you expect to see on current staffing levels?*

Question 2 Result: High level of agreement that policy would have a small positive effect on staffing levels (increase levels).

- Mean=**4.19** (with 4= small positive effect, 5=a large positive effect)
- Interquartile deviation*= **1** (indicating high level of agreement)

Question 3: *If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what impact would you expect to see on patient length of stay (LOS)?*

Question 3 Result: High level of agreement that policy would have a small effect in decreasing patient length of stay (LOS)

- Mean**= 4.24 (**with 4= small effect in decreasing LOS, 5=a large effect)
- Interquartile deviation*= **1** (indicating high level of agreement)

Question 4: *If policy leaders implemented minimum unit-level nurse-to-patient ratios in medical-surgical units, what impact would you expect to see on nurse attrition?*

Question 4 Result: Moderate agreement that policy would have a small impact in decreasing nurse attrition

- Mean: **4.05** (with 4= a small decrease in nurse attrition, and 5=a significant decrease)
- IQD=**2** (indicating less agreement)

**Interquartile deviation is obtained by subtracting the absolute value of the 25th quartile from the absolute value of the 75th quartile. It measures agreement in the answers.*

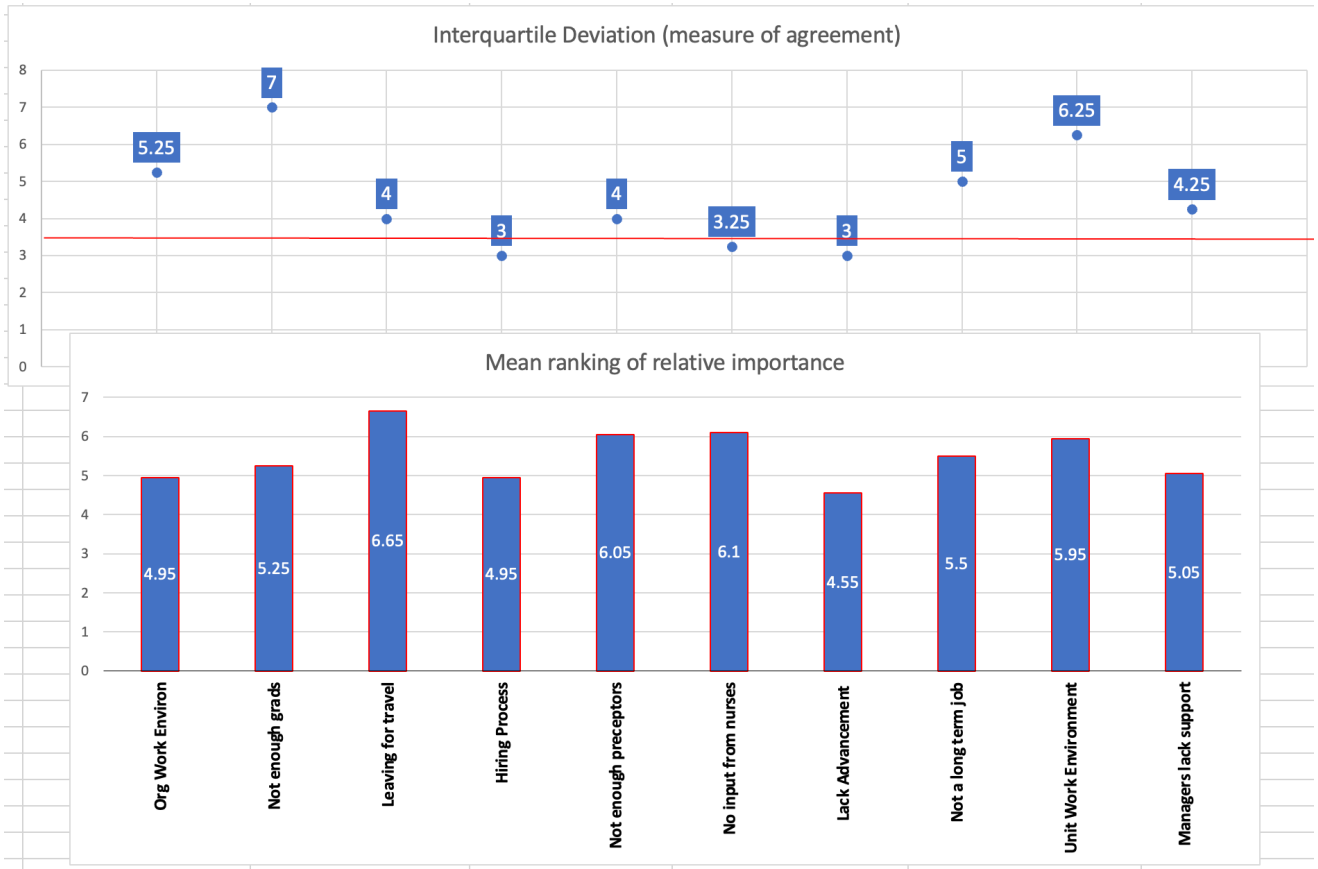
For questions above, I calculated a **Chronbach's alpha of .74** which indicates moderate internal consistency. In other words, for most of the panel, there was consistency in viewing the policy's impact on the separate outcomes (staffing levels, length of stay, nurse attrition) but for others, the impact was different for each factor.
I also used an **ANOVA test** to see if there was a between groups difference for those in direct clinical care roles and those in other roles and found there was NOT.

Question 5: *The factors listed below can contribute to inappropriate nurse staffing. Please rank the impact these factors have.*

> **Result:** The bar graph below shows **the mean** for each of the items provided and the scatterplot shows **the interquartile deviation (level of agreement)**. The red line in the scatterplot chart indicates the cut off between high agreement (below the line) and low agreement (above the line), as a higher interquartile deviation indicates lower agreement. In the bar graph, higher means indicate greater importance.

Here is my interpretation:

- Panelists demonstrate **moderate agreement** that *hiring processes* and *lack of opportunity for advancement* are **less important** in contributing to inappropriate staffing.
- There is also **moderate agreement** among panelists that *lack of input from nurses in staffing decisions* is relatively more important in contributing to inappropriate staffing.
- There are **widely different views** about the importance of other factors, and interestingly, particularly broad differences for the factors *not having enough nurses graduating from nursing school*, *unhealthy unit work environments*, and *unhealthy organization work environments*.

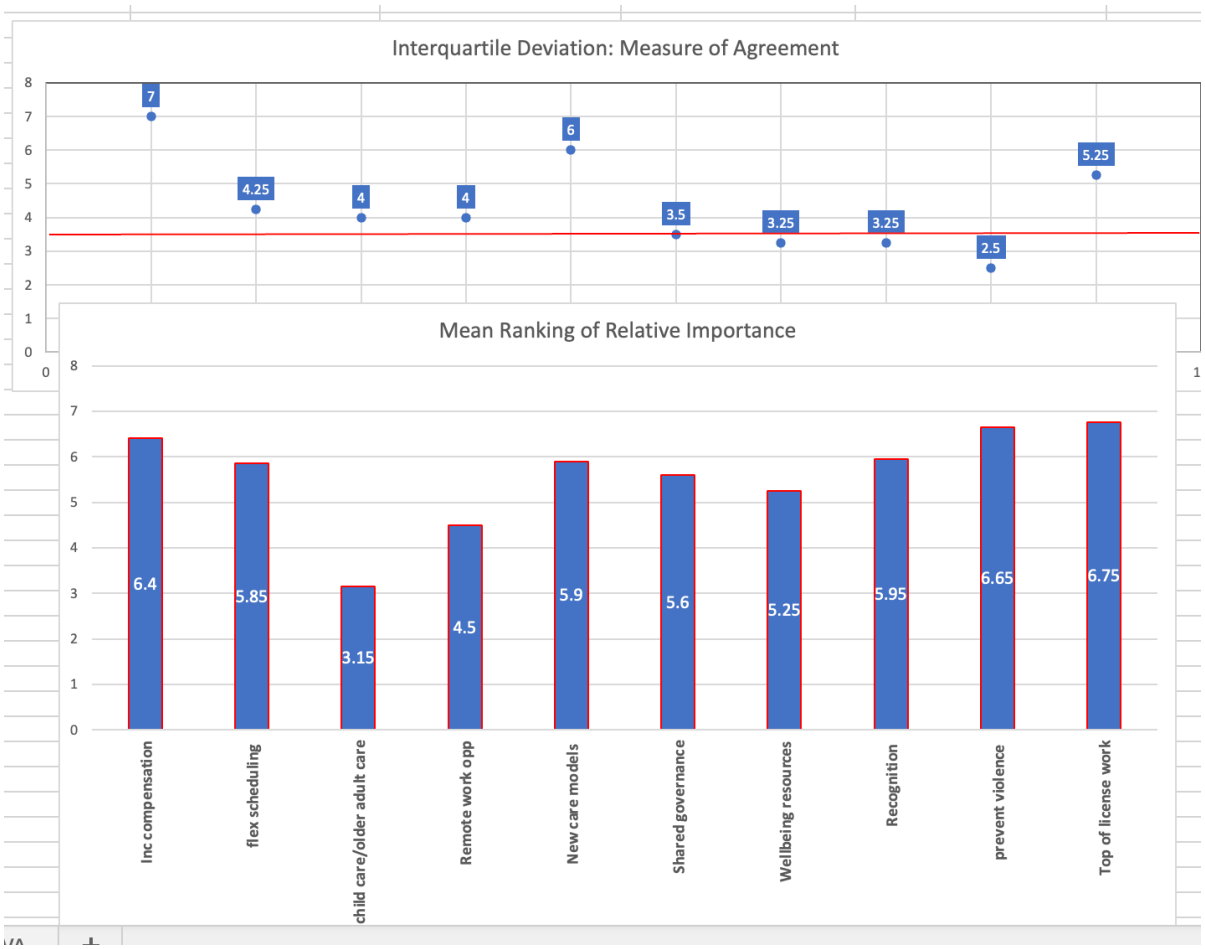


Question 6: *The actions listed below can improve nurse staffing. Please rank how effective you think these actions might be.*

> **Result:** The bar graph below shows the **mean** for each of the items provided and the scatterplot shows the **interquartile deviation** (**level of agreement)**. The red line in the scatterplot chart indicates the cut off between high agreement (<u>below</u> the line) and low agreement (<u>above</u> the line). In the bar graph, higher means indicate greater importance.

Here is my interpretation of Question 6:

- Panelists demonstrate a **high level of agreement** that *preventing bullying and workplace violence* would improve nurse staffing
- Panelists demonstrate a **moderate level of agreement** that *creating shared governance and other structures to involve nurses in decisions*, *providing onsite resources to support emotional wellbeing* and *building processes for recognizing nurses' contributions* would improve nurse staffing.
- There are **widely different views** among the panelists on the impact that *increasing compensation (salary and benefits)* and *investing in creating/testing new models for care delivery* would have on nurse staffing. Additional comments suggested higher compensation for charge nurses and nursing faculty.



Key findings from Question 7: *The intent of a minimum unit level nurse-to-patient ratio policy is to improve patient outcomes by increasing staffing levels. Please list 3 or more unintended consequences of this policy. These could be positive or negative consequences outside the intended effect.*

- The most often noted unintended consequence concerned **ancillary staff** and how unit-level nurse-to-patient ratios might affect them and their number
- Other unintended consequences included increased **cost of care**. Conversely, one comment noted a financial benefit in reducing readmissions and length of stay
- Unintended consequences specific to **hospitals** included increased cost, potential closure, challenges in recruiting nurses, and less incentive to innovate care delivery
- Unintended consequences at the **hospital unit level** included inadequate coverage for breaks, shifting the focus away from other workplace issues, requiring nurses to float to other units based on numbers and not based on acuity, and decreased staffing in units that are currently above the policy minimum.

- Panelists described both **positive and negative consequences for nurses**:
    - *Positive*: Improved job satisfaction, reduced turnover/increased retention, increased flexibility, and empowerment, fewer "killer shifts"
    - *Negative*: Not knowing how many patients they would have on a given shift, getting larger patient assignments too frequently, reduced salary, reduced autonomy, reduced enrollment in APN programs

- Panelists also noted both **positive and negative consequences for patients**
    - *Positive*: Improved safety/reduced harm (*this is the intent of the policy*), reduced length of stay for patients.
    - *Negative*: inequity because some patients would get more care than others, increase in wait time for elective procedures, and use of technology which dehumanizes care
    - One comment noted a positive consequence for more acute patients as they would have more care and a negative consequence for less acute patients who would be part of larger assignments and may face a greater risk for missed care

- Other comments offered **general observations about the policy**:
    - Effective implementation of the policy depends on team dynamic/work environment, to avoid inequitable assignments
    - Effective implementation depends on an accurate evaluation of existing and changing patient acuity to make the variable nurse-to-patient ratios fair
    - The policy is not based on research or evidence (*the evidence used to in developing this project was described in the Survey 1 materials*)
    - The policy does not address variation in nurses' skills and experience
    - The policy does not address overflow such as "hallway beds"

That's it! Please proceed to answer the questions on Survey 2, at this link! Thank you!

Appendix C: Summary of Survey 2 Results (This is the exact transcript sent to panelists)

Question 1: *Please indicate the percent of your professional time that you spend providing patient care.*

- 0% of my time – 8 respondents
- 0-49% of my time – 7 respondents
- 50% or more of my time- 7 respondents

Question 2: *Results from Survey 1 showed consensus that a minimum unit level nurse-to-patient ratio policy could **increase staffing levels**. Please indicate your level of agreement with that result.*

- Mean: **3.27** on a scale of 1 (strongly disagree) to 4 (strongly agree)
- Interquartile deviation=**1**
- 2 respondents disagreed or strongly disagreed

Question 3: *Results from Survey 1 showed consensus that a minimum unit level nurse-to-patient ratio policy could **reduce patient length of stay.** Please indicate your level of agreement with that result.*

- Mean: **2.95** on a scale of 1 (strongly disagree) to 4 (strongly agree)
- Interquartile deviation= **0** (because the 1st and 3rd quartiles were both 3)
- 4 respondents disagreed or strongly disagreed

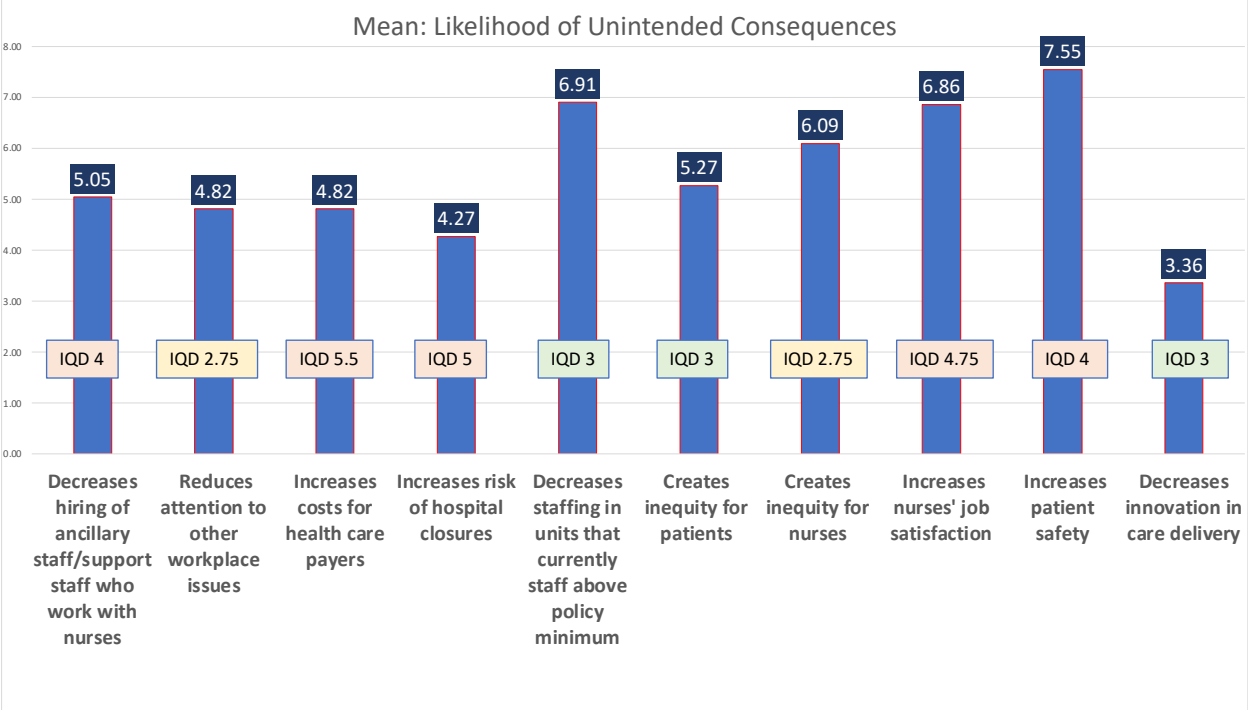
Question 4: *Results from Survey 1 indicate that some panelists believe that a unit level minimum nurse-to-patient ratio policy would **increase nurse retention** (reduce turnover). Please rate your level of agreement with that effect.*

- Mean: **3.14** on a scale of 1 (strongly disagree) to 4 (strongly agree)
- Interquartile deviation= **1** (with IQR 3-4)
- 3 respondents disagreed or strongly disagreed

Sarah's interpretation of questions 2-4: Panelists show moderate agreement that the policy could increase staffing levels, reduce patient length of stay, and increase nurse retention. It is important that some panelists disagree with these outcomes. That disagreement may be related to panelist views on unintended consequences of the policy. For example, if a unit is staffing above the minimum, then the impact may be to decrease (not increase) staffing levels.

Reminder: *Interquartile deviation (IQD) measures agreement in answers. A low IQD indicates high agreement, while a high IQD indicates low agreement.*

Question 5: *Below are unintended consequences (both positive and negative) of the policy from the Survey 1 results. Please use drag and drop to* ***rank order*** *the likelihood of these consequences occurring.* ***1= LEAST LIKELY and 10= MOST LIKELY***



Panel showed a **high** agreement (IQD<3)

- The policy is *not likely* to decrease attention to other workplace issues
- The policy has *moderate likelihood* of creating inequity for nurses

The panel showed **moderate** agreement (IQD=3)

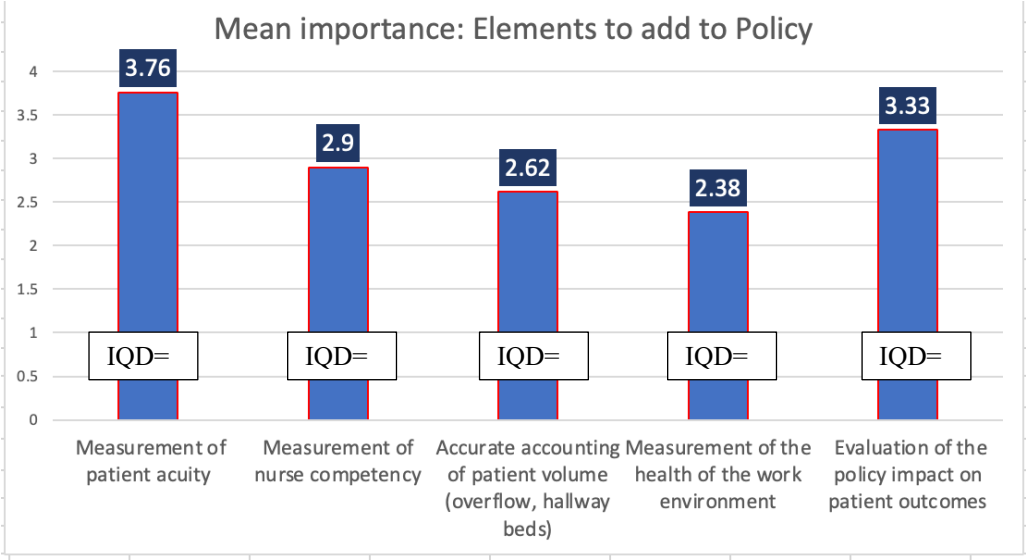
- The policy is *highly likely* to decrease staffing in units staffing above the minimum
- The policy has a *moderate likelihood* of creating inequity for patients
- The policy is *not likely* to decrease care delivery innovation

The panel showed **differing views** on the likelihood the policy would:

- decrease hiring of other staff (IQD=4)
- increase costs for payer (IQD=5.5)
- increase hospital closures (IQD=5)
- increase patient safety (IQD=4)
- increase nurse satisfaction (IQD=4.75)

- The **mode** (or most frequent answer) for *increase patient safety* was **10**, and that item had the highest mean (average score). The **mode** for *increase nurse satisfaction* was **9**, and that item had the third highest mean. Thus, while panelists did not all agree about these two consequences, a portion of the panel felt increases in patient safety and nurse satisfaction were highly likely consequences.

Question 7: *As noted in the results from survey 1, the policy does not include factors that affect implementation. Please use drag and drop to* ***rank order*** *the importance of adding the following elements to the policy.* ***1 = LEAST important and 5 = MOST important***



Areas of moderate agreement:

- The **most important factor** to include in the policy is a requirement to *measure patient acuity*. Comments confirmed that the effectiveness of unit level minimum nurse-to-patient ratios requires accurate measurement of acuity to ensure appropriate nurse assignments, and that we "need better tools" for measuring acuity (Mode=5)

- The **least important factor** to include in the policy is a requirement to *measure the health of the work environment*. In comments, some panelists questioned the relevance of this measurement to the policy. (Mode=2)

- *Measuring nurse competency* and requiring an *accurate accounting of patient volume* are **moderately important** to include in the policy.

- Comments regarding the *measurement of nurse competency* showed a variety of views: nurse competency was noted to have a significant impact on patient care. Separate comments observed that all nurses have the same baseline competency, and that higher competency does not equate to the ability to take larger patient assignments.

- Panelists were similarly mixed on the *accounting of patient volume*, with some comments that this is crucial and others noting that volume is already measured accurately.

Panelists showed **less agreement** regarding including a requirement to *evaluate the impact on patient outcomes.* The mode was 5, indicating high importance to some and comments noted that the impact on patient outcomes is the aim of the policy. Other comments noted that all 5 of these factors were equally important.

Question 9: *The proposed policy, unit level nurse-to-patient minimum ratios in medical-surgical settings, creates change for multiple stakeholders. Use the slider bars below to rate how implementing this policy could change the current state for the following groups:*
***1 = a change for the worse** and **4 = a change for the better**.*

Mean Scores for the change policy would create**:**

- Nurses: 3.41
- Patents 3.32
- Health care team (non-nurses): 2.86
- Nurse Managers: 2.68
- CNOs: 2.68
- Payers (insurers, Medicare, Medicaid): 2.64
- Non-nurse hospital leaders (CMOs, CFOs): 2.50

IQD for all of scores of stakeholder impact was 1, indicating agreement
****The slider bar for question 9 was not configured to accept non-whole numbers!! As a result, I am going to ask this same question again on Survey 3 to precisely measure your views on the impact of the policy on these groups****

Panelist comments for this question noted a variety of views:

- A mixed effect for managers and CNOs who might find that their teams are happier though they themselves "*have to focus on productivity and cost*".
- Some felt the policy would lead to a somewhat better change for nurses and patients, while creating challenges for leaders, as they would have to "find money" for more nurses
- Comments also observed existing differences between nurses and leaders, as leaders "*remain unchanged while the direct care nursing staff are feeling the negative effects*" or administration "*makes decisions without understanding what is going on*"
- In contrast, a panelist noted the commonality between leaders and staff, stating "*Nurses and nurse leaders all want better staffing. Challenging staffing consumes us*".

THEMES FROM NARRATIVE DATA: *The comments on Survey 2 were incredibly thoughtful and I am so grateful for the time and care each of you put into this!*

Comments related patients:

- Some noted that patients might experience a decrease in access to care or longer waits for elective procedures.
- Others that patients would experience fewer medical errors, higher quality care, and "little doubt" that patient safety overall would improve.

These different views about the consequences of the policy may explain the low level of agreement about patient safety being a consequence of the policy.

Comments related to nurses:

- Comments mentioned that the policy could lead to mandatory overtime and thus a decrease in nurse satisfaction.

- Others noted that "research shows" ratio policy increases nurse satisfaction, that staffing is a cause of nurse dissatisfaction and a reason to leave a position, and that the policy might lead to "less burnout and less chaotic shifts", and nurses having "more time for patients"

These different views may explain the low level of agreement about nurse satisfaction being a consequence of the policy.

Comments related to cost: showed significant differences of opinion, and this consequence also showed the lowest level of agreement in the quantitative analysis of Question 5

- Some noted that hospitals would have to pay for more staff or hire agency nurses increasing costs. Another that hospitals would shift budgets to labor costs due to nurse shortage.
- Other comments indicated that the policy could lower costs because of improvements in the patient safety or to improved quality of care, leading to a "net savings". Another noted the policy could increase patient satisfaction so more patients will return for care and recommend the hospital to others.

Comments related to innovation: Though the quantitative analysis showed more agreement

about this consequence, the comments showed strong opinions in both directions

- Some described the policy as likely to increase innovation, because nurses will have more time to innovate, be free to innovate, or be more involved in innovation.
- "Innovation is essential" so would not be affected by the policy.
- Other panelists noted that strict rules limit innovation and the policy might narrow attention to just this rule. A decrease innovation might occur if hospitals default to assigning the same number of patients to each nurse or "if nurses are not involved in decisions about patient assignments".

Comments related to the process making staffing decisions

- The policy could have a positive consequence in taking "the pressure off" managers who advocate for more staff.
- The policy may have little impact on staffing decisions, and to be effective a minimum ratio would include ongoing evaluation and a "commitment to continued conversation".
- The policy may lead to decisions to avoid staffing above the minimum level in the policy (this aligns with the high mean for *decrease staffing in units currently staffed above the minimum* as an unintended consequence)
- One noted "I am very curious to know how the unit-level ratios would be set" and "who would be part of those conversations"
- Other comments expressed concern that the policy might negatively affect staffing process:
  - The policy might "remove the ability to use clinical judgement" in staffing decisions
  - Setting a minimum might "stifle innovation" as staffing is just a "box is ticked"

Long term and short-term consequences: comments also noted a distinction between long and short-term consequences of the policy

- A comment that the policy could "cost more money upfront but improved outcomes and decreased LOS can improve the financial aspect"

- Another that “in the long run, safer staffing ratios positively impact everyone”
- “Short term- possible payer frustrations, long term- they might grow to like policies like this”

Additional Unintended Consequences: Finally, in reviewing the comments, I looked for additional unintended consequences that were not included on Survey 2. (SPOILER ALERT: We will look at these together on Survey 3). Below is the list I found:

- Decrease in medical errors (for patients)
- Improve quality of care (for patients)
- Decrease access to care (for patients)
- Increase waits for elective procedures (for patients)
- Increase in mandatory overtime (for nurses)
- Increase time with patients (for nurses)
- Decrease burnout (for nurses)
- Unregulated floating (for nurses)
- Make the work environment worse (health care team)
- Increase the use of travel or agency staff (health care team)

Appendix D: Summary of Survey 3 Results (This is the exact transcript sent to panelists)

Question 1: *Please indicate the percent of your professional time that you spend providing patient care.*

- 7 respondents spend 0% of their time providing patient care.
- 9 respondents spend 1-49% of their time in providing patient care.
- 6 respondents spend 50% or more of their time providing patient care.

Question 2: *Please rate your level of agreement that establishing a unit-level minimum nurse-to-patient ratio would improve patient safety.*

Question 2 Result: High level of agreement that policy would increase patient safety.

- Mean=**3.41** (with 3= somewhat agree, 4= strongly agree)
- Interquartile deviation*= **1** (indicating high level of agreement)
- 1 panelist selected *somewhat disagree*, the rest selected *somewhat* or *strongly agree*.

Question 3: *Please rate your level of agreement that establishing a unit-level minimum nurse-to-patient ratio would improve nurses' job satisfaction.*

Question 3 Result: High level of agreement that policy would increase nurse satisfaction.

- Mean**= 3.41 (**with 3= somewhat agree, 4=strongly agree)
- Interquartile deviation*= **1** (indicating high level of agreement)
- All panelists selected *somewhat agree* or *strongly agree.*

*Interquartile deviation is obtained by subtracting the absolute value of the 25th quartile from the absolute value of the 75th quartile. It measures agreement in the answers.

Question 4: *In survey 2, some panelists noted that the policy's effect on cost might be different in the short and long term. Please select the option below that reflects your view.*

Question 4 Result: High agreement that the policy will increase short term costs as no panelist selected the statements that indicated *decrease short-term costs*. Panelists did not agree about the impact on long term costs.

7 panelists- policy will increase costs both short and long term.
14 panelists- policy will increase costs in the short term and decrease costs in the long term.
1 panelist- no impact on cost.

Question 5: *Comments on Survey 2 revealed different opinions regarding the minimum unit-level nurse-to-patient ratio policy's effect on innovation in care delivery. In your view, implementation of this policy will lead to***:**

Question 5 Result: most participants predicted the policy would result in somewhat more innovation. There is diversity in panelist views on this consequence.

1 Panelist- much less innovation; 4 **Panelists**- somewhat less innovation
12 panelists- somewhat more innovation; **5 panelists**- much more innovation

Table to display results from Questions 2-5: The table below lists the information described above, giving the number and percentage of panelists who selected each response.

Improve patient safety	*Strongly disagree* **0** panelists (0%)	*Somewhat disagree* **1** panelist (4.55%)	*Somewhat agree* **11** panelists (50%)	*Strongly agree* **10** panelists (45.45%)
improve nurses' job satisfaction	*Strongly disagree* **0** panelists (0%)	*Somewhat disagree* **0** panelists (0%)	*Somewhat agree* **13** panelists (59.09%)	*Strongly agree* **9** panelists (40.91%)
Increase/decrease short- and/or long-term costs	*increase costs, both short and long term* **7** panelists (31.82%)	*increase costs in the short term, and decrease costs in the long term* **14** panelists (63.64%)	*No impact on cost* **1** panelist (4.55%)	**No** panelists (0%) chose the 2 items that included *decrease costs in short term*
Increase or decrease innovation	*much less innovation* **1** panelist (4.55%)	*somewhat less innovation* **4** panelists (18.18%)	*somewhat more innovation* **12** panelists (54.55%)	*much more innovation* **5** panelists (22.73%)

Question 6: *In Survey 2, we identified that the policy could have both negative and positive consequences for PATIENTS. Please drag and drop the following statements from LEAST likely to occur to MOST likely to occur. (1=least likely, 5=most likely)*

Question 6 Result: There was high agreement among the panel that the positive consequences of the policy were likely to occur and the negative consequences were less likely to occur.

Consequences for Patients	Mode	Mean score of likelihood	IQD: Level of agreement
Increase quality of care	5	4.32	1
Increase patient satisfaction	3	3.64	1
Decrease errors and missed care	4	3.59	1
Delay elective procedures	2	1.91	1
Decrease access to care	1	1.55	1

Question 8: *In survey 2, we identified that the policy could have negative and positive consequences for NURSES. Please drag and drop the following statements from LEAST likely to occur to MOST likely to occur. (1=least likely, 5=most likely)*

Question 8 Result: There was disagreement among the panel about the consequences of the policy for nurses. Given the agreement in question 3, my interpretation is that panelists believe that increasing staff levels will generate higher satisfaction, but the mechanisms employed to adhere to a policy about staffing (floating, overtime) need to be considered.

Consequences for Nurses	Mode	Mean score of likelihood	IQD: Level of agreement
Increase time with patients	5	4.14	1.75
Decrease burnout	4	3.59	1.75
Floating to unfamiliar units	3	2.73	1
Increase mandatory overtime	1	2.41	2.75
Decrease involvement in staffing decisions	1	2.14	2

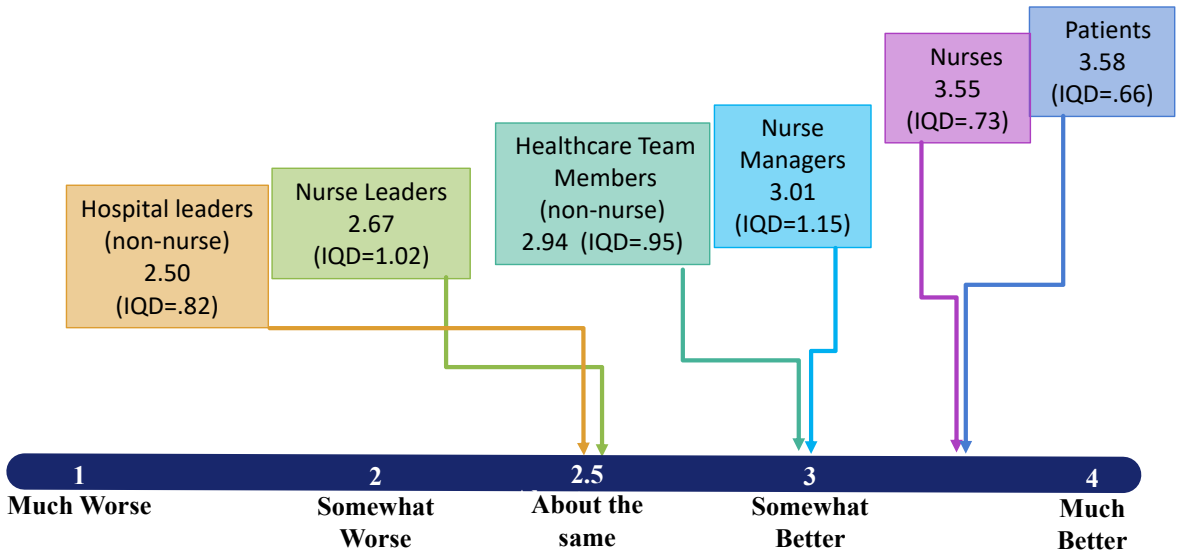
Question 10: *In Surveys 1 and 2, we identified unintended consequences that the policy could have on HEALTH CARE TEAMS. Please drag and drop the following statements from LEAST likely to occur to MOST likely to occur. (1=least likely, 5=most likely)*

Question 10 Result: The panelists agreed that the policy was NOT likely to *cause hospitals to close* or *create a worse work environment*. There was also agreement that the policy was moderately likely to *reduce dialogue about staffing decisions*. The panelists rated *increase in travel agency nurses* and *decrease hiring of support staff* as highly likely but disagreed about which one was most likely.

Consequences for Healthcare teams	Mode	Mean score of likelihood	IQD: Level of agreement
Increase travel agency nurses	5	4.14	1.75
Decrease hiring of support staff	4	3.86	1.75
Reduce dialogue @ staffing decisions	4	3.41	1
Create worse work environment	2	1.91	1
Cause hospitals to close	1	1.68	1

Question 12: *The proposed policy, unit level nurse-to-patient minimum ratios in medical surgical settings, creates change for multiple stakeholders. Use the slider bars below to rate how implementing this policy could change the current state for the following groups: 1 = a change for the worse and 4 = a change for the better.*

The information is presented below on a number scale. The IQD scores of ≤ 1 indicate high agreement about these ratings.



Question 12 Result: Panelists agree that the policy will create a somewhat better state for nurses and patients and have less effect on leaders.

Question 13: *Please rate your level of satisfaction with the experience of being a panelist in this project.*

- Extremely satisfied: 81.82% (18 responses)
- Somewhat satisfied 18.18% (4 responses)
- No panelists selected Neither satisfied nor dissatisfied, Somewhat dissatisfied, Extremely dissatisfied

Question 14: *Please rate the effectiveness of the Delphi Policy methodology in analyzing a nurse staffing ratio policy.*

- Extremely effective: 33.33% (7 responses)
- Very effective: 38.10% (8 responses)
- Moderately effective: 28.57% (6 responses)
- No panelists selected Slightly effective or Not at all effective

Questions 13 and 14 Result: panelists were satisfied with their role in the project and felt it was effective in analyzing the proposed policy.

Themes from qualitative data:

There is agreement that better staffing would have positive effects on patients and nurses and disagreement about the policy's other effects which may mitigate those benefits.

- Many comments connected the policy to increased staffing and emphasize the **intended consequences** of the policy
    - Comments described that *more nurses mean more time with patients* which means better care. Some included that higher staffing levels would lead to more attention to detail, fewer errors, more opportunities to address patient satisfaction.
    - Some note the policy brings *stability*, or a chance for nurses to *know* or *anticipate* what staffing will be, rather than making frequent adjustments in planning care.

- Other comments focus on how the requirements of policy will be met. Those comments give greater attention to negative **unintended consequences** (mandatory overtime, agency nurse use, delays in elective care). Related comments:
    - Nurses will do *more tasks* that are not top of license.
    - Nurses will float to other units *based on numbers and not on patient needs*.
    - *Changes in team composition* will be necessary to maintain financial balance.

- Some note *there are not enough nurses* to enable policy adherence.

- Comments indicated concern that there will *less discussion/thought put into staffing* decisions with the policy in place. Leaders may "default" and assign same number of patients to each nurse, as in patient-level ratio.

Brief sketch of my conclusions:

- The panel shows consistent agreement that a unit-level ratio policy for adult medical-surgical units could benefit nurses and patients and increase short-term health care costs.
- There are mixed opinions about other consequences including: impact on innovation, health care team composition, and long-term costs.
- Mixed views may arise from a focus on *how* the policy would be adhered to versus a focus on the *outcome* of higher staffing levels.
- The proposed policy offers a simple solution to a complex phenomenon. It has benefits and it will not generate the full measure of change that health care work environments need.
- If the policy were implemented, crafting it to mitigate unintended consequences is crucial.
- We need thoughtful, considerate, collaborative engagement from diverse stakeholders to inform policy creation.
- The Delphi methodology is effective in creating a forum for gathering different perspectives on a complex and controversial topic.

TABLE OF EVIDENCE

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
McHugh, M. D., Aiken, L. H., Sloane, D. M., Windsor, C., Douglas, C., & Yates, P. (2021). Effects of nurse-to-patient ratio legislation on nurse staffing and patient mortality, readmissions, and length of stay: A prospective study in a panel of hospitals. The Lancet, 397(10288), 1905–1913. https://doi.org/10.1016/S0140-6736(21)00768-6	Assess the effect of a minimum nurse-to-patient ratio policy on staffing and patient outcomes (length of stay, (LOS) mortality, readmission) in medical-surgical units in Queensland	Queensland, AUS, medical surgical unit nurses & patients. 27 hospitals were affected by policy implementation and 28 were not (the comparison group) 231,902 patients in pre-implementation (142,986 in intervention) and 257,253 in post implementation (160,267 intervention). Policy implementation took place in 2016	Prospective quasi-experimental panel study Nonrandom assignment to intervention or comparison group Nurse surveys measured staffing levels Queensland Hospital Admitted Patient Data Collection measured patient outcomes Data was collected before policy implementation and 2 years after: 30-day mortality, 7-day readmission, LOS The policy implemented required a minimum nurse-to-patient ratio in medical-surgical units but did not dictate allocation of workload.	Survey response rate: 32% before, 27% after. Comorbidity was not significantly different between the two groups Baseline pts/nurse Comparison 6.13 Intervention 4.84 After policy pts/nurse Comparison 5.96 Intervention 4.37 Standard deviations show > variability in comparison group Decreasing 1 pt/nurse decreased odds of mortality (p=.04), and readmission (p=.0001) LOS: Greater magnitude of change in intervention group than comparison (p=.010)	**Strengths**- prospective large sample size. Used modeling to compare co-morbidity & predict patient outcomes **Limitation**- nonrandom, unable to match intervention & comparison group hospitals; does not show unit level impact. Relied on nurse report for staffing levels. **30-day mortality** increased after policy implementation in comparison group and dropped in the intervention group. **Readmissions** went up in both groups after implementation but by a lower margin in the intervention group **Length of stay** dropped in both groups but by a greater margin in intervention group (5% in comparison, 10% in intervention). **Cost savings** of reduced LOS and readmissions was twice the cost of hiring more nurses **Conclude**: Minimum nurse to patient ratio policy improves outcomes and is cost-effective

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Han, X., Pittman, P., & Barnow, B. (2021). Alternative approaches to ensuring adequate nurse staffing. *Medical Care*, *59*(10 Suppl 5), S463–S470. https://doi.org/10.1097/MLR.0000000000001614 *This study compares staffing levels in a state with a numeric policy (like the one analyzed in this project) to levels in states with other types of staffing policies, and those with no policy*	Determine impact of alternative legislative approaches on the level of nurse staffing in acute care hospitals	States in U.S. with variation in staffing regulation: At time of study- 2 states have ratios (CA across all units, MA in ICU). 7 states require committees with 50% direct care; 5 states require public reporting of staffing Study excluded 5 states with > one policy, and hospitals with average daily census <20 5188 hospitals total (427 ratios, 1020 committees, 324 reporting, 3417 with no legislation)	American Hospital Association (AHA) data, collected annually from 2003-2018, on productive hours per patient day for RNs, LPNs, and nursing assistive personnel (NAP) in 5188 hospitals Linked AHA data to state data using the National Conference of State Legislatures and the Bureau of Labor Statistics Occupational Employment Statistics Compared staffing levels in hospitals among the 24 states with legislative approaches to each other and to states without legislation. Difference-in-difference design over 16 years Controlled for hospital ownership, location and size, teaching status, and percent Medicare/ Medicaid days	AHA survey has a 75% response rate No difference in total licensed hours in states with staffing committees, while public reporting and mandatory ratios demonstrated an increase in total licensed hours (LPN +RN) over the 16 years Neither committee nor reporting lead to significant increase in RN hours or NAP hours but did impact LPN hours NAP and RN hours increased in CA following ratio mandate by a statistically significant margin compared to other groups, no change in LPN	**Strengths:** sample size and volume of data, controlling for hospital characteristics, consistency of these results with other findings makes bias less likely the cause of the results **Limitations:** AHA data does not capture changes in nurse hours (PT vs FT), and does not separate managers from direct care roles, and accuracy of "adjusted patient days" varies inpatient vs outpatient. Also, hospital level data does not demonstrate effect of staffing on individual units, and AHA definition of NAP is unclear **Conclusions:** • Mandatory ratios had a significant positive effect on RN and NAP hours, and no effect on LPN hours. • Staffing committee laws do not affect RN, LPN, or NAP hours • Public reporting laws have a small effect when CA was not included in the analysis and mostly affect LPN hours. Lack of impact seen w/ committees may be due to variability in how empowered committees are to address staffing levels

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Needleman, J., Liu, J., Shang, J., Larson, E. L., & Stone, P. W. (2020). Association of registered nurse and nursing support staffing with inpatient hospital mortality. *BMJ Quality & Safety*, *29*(1), 10–18. https://doi.org/10.1136/bmjqs-2018-009219 *This study demonstrates the negative consequences of inappropriate staffing – (the clinical problem being examined)*	To examine the relationship between patient mortality and exposure to lower than median staffing levels Examined RN staffing, support staffing and high patient turnover	5 years of data from urban academic hospitals in the US- with over 2000 beds Total of 78,303 patients (excluded pediatric, surgical-OR LOS<3days, those with missing data, those on psych, labor, or research units) 47% male, mean age 62 Identified shifts that were understaffed based on payroll data- looked at RN data and combined LPN and NAP data	A secondary data analysis, 4 Cox proportional hazard regression models Independent variables: exposure to shifts that had 75% or less staffing than median staffing on that unit for each category of staff (RN and support). 2 models used days 2-5 of admission as early low staffing may have a more profound effect, and LOS increases exposure to low staffing and mortality High turnover if > or equal to mean plus 1 SD of day-shift turnover Dependent variable: death at hospital discharge Constructed 4 models of relationships hazard ratio (HR) of mortality and exposure to staffing levels and unit turnover	133,742 staffed unit-shifts; 43% in med-surg units, 41% in ICU, 16% stepdown. low RN staffing: 10% of day shifts 9% of night shifts Low support staff 22% of day shifts 23% of nights shifts 4.3% of shifts low on both RN and support Model 1: low RN corelated w/ higher HR (p< .001) Model 2: 2nd-5th days, low RN correlated w/ higher HR (p< .001) Model 3: low RN associated w/ higher HR (p=.035) low support correlated w/ higher HR (p< .001) Model 4: low RN not correlated to HR (p>.05); exposure to both low RN and low support increased HR (p< .001)	**Strengths:** longitudinal not cross sectional- periods of exposure to low staffing preceded death so cause and effect is plausible. Model 4 in the study isolated days 2-5 to address impact of LOS- this affected significance as included smaller number of low RN shifts in this model. Authors note that the Model 4 results support association bet RN staffing and mortality **Limitations:** measured low staffing based on typical staffing, cannot be certain that the 75% threshold is the correct one to use, and cannot verify that the median staffing on the unit was appropriate staffing. Setting was large urban hospitals- may need to repeat work in other environments. **Conclusion:** Exposure to low staffing- both RN and support- was associated with increased mortality. When both are low, the risk was further elevated in one of the four models. Authors advise hospitals to collect data on the frequency of understaffing and to strive for adequate RN and support staff levels

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Winter, S. G., Bartel, A. P., Cordova, P. B., Needleman, J., Schmitt, S. K., Stone, P. W., & Phibbs, C. S. (2021). The effect of data aggregation on estimations of nurse staffing and patient outcomes. *Health Services Research*, *56*(6), 1262–1270. https://doi.org/10.1111/1475-6773.13866 *This study shows the impact of understaffing on patient LOS*	Examine changes in the association between nurse staffing and patient LOS based on how data is aggregated (by setting and time interval), and controlling for un-observed hetero-geneity	Used Veterans Affairs (VA) data from 143 facilities including 215 ICU and 438 general acute care units, data collected 2002-2006 Excluded 1-2% of observations due to missing data	Retrospective observational design, using unit level panel data and measuring the association of hours of nursing care with patient LOS across month long and yearlong intervals, with and without applying fixed effects **Independent variable**: monthly total nursing hours per patient day (NHPPD), and the percent of hours by LPNs, NAPs, and contract nurses **Dependent variable**: length of stay (LOS), representing a *combined indicator of adverse patient outcomes* (p.1264). Measured LOS as the log of the actual LOS minus the log of the expected LOS (which was the median LOS from Medicare data).	Higher NHPPD significantly associated with shorter patient LOS. Monthly data showed higher magnitude difference than annual data particularly in general acute care (where staffing variation is greater). Higher proportions of care by LPNs associated with longer LOS across all models (annual, monthly, unit, hospital, fixed or not fixed effects), Higher proportions of care by NAP or contract nurse were associated with longer LOS with higher magnitude in monthly data	**Strengths:** • Size of the data set • Use of unit level rather than hospital level data to more accurately approximate care received by patients • Mitigated *reverse causation* by measuring LOS as residual LOS (actual LOS-expected LOS, based on Medicare DRG). **Limitations:** • measured nursing hours worked not hours of care • there may be more unknown differences between hospitals/units that fixed effects did not adjust for • VA facilities do not drop staffing when census falls so might have higher hours than other places **Conclusion**: there is significant variation when data are aggregated over time and setting. Hospital level and annual data may underestimate the impact of staffing on patient outcomes while monthly and unit specific analysis may be more accurate in demonstrating the magnitude of association

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
French, R., Aiken, L. H., Rosenbaum, K. E. F., & Lasater, K. B. (2022). Conditions of nursing practice in hospitals and nursing homes before COVID-19: Implications for policy action. *Journal of Nursing Regulation*, *13*(1), 45–53. https://doi.org/10.1016/S2155-8256(22)00033-3	Provide pre-pandemic data on nursing working conditions, job outcomes, patient safety, and quality of care to inform policy decisions in pandemic recovery	RNs surveyed in New York and Illinois between 12/2019 and 2/2020 33,462 RNs total answered the survey, 89% were hospital employed, 10.8% nursing home employed 73.8% had BSN (76.6% of hospital RN and 50.7% of nursing home)	Cross-sectional survey data; emailed to all actively licensed nurses in NY and IL Used Maslach Burnout Inventory Likert scale for job satisfaction, agreement with policy options, and culture of safety. 10-point scale for importance of factors in improving safety 4-point scale used for overall work environment and 5 components of environment based on PES-NWI Hospital nurses rated frequency of not performing specific tasks, of doing non-nursing tasks, and of interruptions in their work	Response rate 18% Hospital RN subset: 41% reported burnout, 20.7% intent to leave; 40.9% gave a C or lower grade for overall safety; 42% reported 1 or more missed care task, 88% reported work interrupted/ delayed by insufficient staff Factors to improve safety: 95% - patient to nurse staffing ratio 94%- reduce burnout 91% improve working conditions Staffing-lowest rated component of work environment (54.4% disagreed "*have enough staff*") Favorable rating of teamwork, leadership	**Strengths**: • Separated hospital and nursing home in most of the responses • table shows percentage, raw number and the actual item asked on the survey (full disclosure of data)- other reports about this data set did not provide that detail **Limitations:** • low response rate • sent survey to all licensed nurses regardless of employment status so results are not setting/ unit specific • results are from 2 states, cannot generalize to all 50 **Conclusion:** Nurses favored Nurse Licensure Compact (pre-pandemic) Nurses reported poor working conditions particularly understaffing, and reported patient safety concerns before COVID-19 Authors connect this to McHugh et al (2021) and other observational data to conclude that legislated staffing minimums can save lives and generate cost savings

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Cook, A., Gaynor, M., Stephens Jr, M., & Taylor, L. (2012). The effect of a hospital nurse staffing mandate on patient health outcomes: Evidence from California's minimum staffing regulation. *Journal of Health Economics*, *31*(2), 340–348. https://doi.org/10.1016/j.jhealeco.2012.01.005	Determine impact of ratio legislation on RN HPPD and on rates of pressure injury (PI) and failure to rescue (FTR)	Statewide patient discharge database from CA OSHPD From 2000-2006 (mandate passed in 2004, so this was before/after study) Also used financial data from OSHPD to determine staffing levels	Retrospective analysis of database Used regression analysis, divided hospitals based on pre-mandate staffing levels and to compare staffing levels and rates of PI and FTR before and after mandate implementation	Changes in staffing levels were significant, and most profound among hospitals with poor staffing prior to mandate Changes in patient outcomes were not significant, and there was not a disproportionate change in FTR among hospitals where the most significant staffing changes occurred	**Limitations:** Before/after study design assumes that data collection/reporting was consistent over both time periods (did FTR and PI reporting change?) **Conclusions**: mandated patient level ratios do increase staffing levels (i.e., reduce the number of pts per RN) even without a specific consequence for failed compliance. Impact on patient outcomes is unclear.

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Spetz, J., Harless, D. W., Herrera, C.-N., & Mark, B. A. (2013). Using Minimum Nurse Staffing Regulations to Measure the Relationship Between Nursing and Hospital Quality of Care. *Medical Care Research and Review*, *70*(4), 380–399. https://doi.org/10.1177/1077558713475715	Examine the impact of CA ratio legislation on six patient outcomes using AHRQ software	Nonfederal general acute care hospitals in California Used CA OSHPD from 2000-2006, used patient level data and AHRQ Patient Safety Indicators (PSI) software to calculate outcomes OSHPD financial data to measure staffing levels as HPPD Six PSIs: FTR, PI, infection due to medical care, post op respiratory failure, post op DVT, and sepsis	Correlation between LOS and staffing across all skill levels, with consideration of nursing intensity Divided hospitals into quartiles based on pre-legislation staffing Difference in difference models to determine the effects of changes in staffing on PSIs (w/ fixed effects), Multivariate analysis of each PSI as a dependent variable, and marginal impact of increasing HPPD by 1 hour Significant increases in mean HPPD post regulation: Quartile 1- 1.91 Quartile 2- 1.93 Quartile 3- 1.71 Quartile 4- 0.76	Post regulation changes in PSI measured by comparing lower 3 quartiles to Quartile 4- mostly not significant or there was an increase Quartile 4 (comparison): 4 PSIs increased. Quartile 1: significant improvement in morality after complication, less increase in PE/DVT Quartile 2 and 3: transition period showed improvement in morality following complication No significant change in patient outcomes based on analysis of marginal effects of 1 hour increase in NIW-adjusted RN HPPD	**Limitations**: the AHRQ software limited how they could look at outcomes (for instance, they could not look at overall LOS); Quality improvement implementation during the timeframe of the study may confound results **Conclusions:** Legislation did increase staffing, but findings related to patient outcomes are mixed Hospitals with lower pre-regulation staffing experienced significantly greater increases in staffing and significantly greater decreases in mortality after a complication Increased staffing was associated with lower rates of mortality, and to a limited degree, increased staffing was associated with shorter LOS for pts with complications Policy should be carefully considered

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Dierkes, A., Do, D., Morin, H., Rochman, M., Sloane, D., & McHugh, M. (2022). The impact of California's staffing mandate and the economic recession on registered nurse staffing levels: A longitudinal analysis. *Nursing Outlook*, *70*(2), 219–227.https://doi.org/10.1016/j.outlook.2021.09.007 *This study demonstrates the variation in staffing based on nation economic (Macro-level in model)*	Compared staffing in CA to other states over the course of the recession	American Hospital Association data from 1997 through 2016	Longitudinal retrospective analysis of annual mean HPPD. Created adjusted models for hospital characteristics reported to AHA. Difference in difference design to look at RN HPPD pre and post mandate and before/during/after 2008 recession	Mean RN HPPD in CA increased after mandate (from 6.03 to 7.90). The change during the same period for other hospitals was from 6.03 to 6.73 ($p<.05$ comparing after mandate staffing between two groups) During recession, staffing in other hospitals was initially stable and then fell, while staffing in California was stable.	**Limitations:** retrospective, AHA data does not separate admin from direct care; Aiken et al (2010) describe a prior analysis in which nurse reported staffing was found to be more accurate than AHA data **Conclusions:** CA's mandated ratio policy led to improved stability in staffing during a period of economic recession

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Smith, J. G., Plover, C. M., McChesney, M. C., & Lake, E. T. (2019). Isolated, small, and large hospitals have fewer nursing resources than urban hospitals: Implications for rural health policy. *Public Health Nursing*, phn.12612. https://doi.org/10.1111/phn.12612 *This study demonstrates variation in staffing by hospital type and location (Meso-level in model)*	To assess the regional variation (urban vs rural) in nursing resources in the US	Hospitals that responded to a multi-state survey- California, Florida, Pennsylvania Hospitals were included if at least 5 of their nurses replied to the survey, and divided into groups: 566 urban 49 large rural 18 small rural 9 isolated Variations between groups in ownership, and unit size (more patients/unit in urban)	Cross sectional, descriptive, comparative Data from the Multi-state Nursing Care and Patient Safety Study was compared to AHA data on hospital size and zip codes were used to group hospitals as rural, urban. Rural hospital further classified as "large" "small" or 'isolated" Multi-State Survey asked demographic data and included PES-NWI (work environment tool) Ratios based on number of patients per unit divided by number of nurses Used one way ANOVA to compare groups; used Shapiro-Wilk Statistic to demonstrate ANOVA as acceptable tool	Survey response rate 39%- earlier work determined limited response bias Mean pts per nurse: Urban 4.8pts/RN Large: 5.6 pts/RN Small: 5.6 pts/RN Isolated: 7.3pts/RN Skill mix- % RNs (of total w/LPN, NAP) Urban 76% Large 73% Small 73% Isolated 65% No Significant differences in work environment P<.01 in comparing ratios in urban to large and to isolated and in skill mix between urban and isolated P<.05 in skill mix between urban and large	**Strengths**: size of data set **Limitations**: the data used are from 2005-2009 (old- pre-ACA); Ratios measured at hospital level, and some hospitals had few nurses reporting so outliers may have affected the measured ratios; uneven group size; had missing data but did a sensitivity analysis to determine that it did not affect results **Conclusions:** Skill mix and nurse to patient ratio varied significantly based on geography Nurses in large rural and isolated hospitals are significantly less likely to have BSN than those in urban Nurse ratings of resource adequacy showed significant difference between urban and small rural hospitals, and between large and small rural hospitals but no difference with isolated hospitals. Plausible that isolated hospitals are accustomed to existing resources?

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Porcel-Gálvez, A. M., Fernández-García, E., Rafferty, A. M., Gil-García, E., Romero-Sánchez, J. M., & Barrientos-Trigo, S. (2021). Factors that influence nurse staffing levels in acute care hospital settings. *Journal of Nursing Scholarship*, *53*(4), 468–478. https://doi.org/10.1111/jnu.12649 *This study demonstrates the variation in staffing based on hospital type (meso-level in model)*	To determine factors that are correlated to nurse staffing levels. Looked at two groups of data: hospital characteristics and patient characteristics	Random selection of patient based on ID number in EHR Conducted in med surg units in Spain in 2015 Looked at 1004 patients, 52.2% male in 10 hospitals (3 large, 3 medium, 4 small) 157 nurses collected the data after attending training	Independent variables Patient: age, gender, length of stay and acuity and dependency (using INICIARE scale and Barthel Index) Hospital: hospital type/size, unit type (medical vs surgical), shift (day/evening/night), season Dependent variable: Nurse staffing level was measured by a single self-report question-noting # of pts cared for and # of nurses on last shift Chi square association between categorical and ordinal variables Created a null model (no explanatory variables) and an explanatory model and calculated the log likelihood ratios for each model to determine if independent variables improved the model fit	56.2% of patients had a severe or moderate Barthel index (needing help with ADLs); 52% were high care dependent on INICIARE scale Highest staffing levels were in medium hospitals, in summer 63.4% of NSL variance in staffing levels was explained by patient characteristics, 71.8% by hospital characteristics Season and type of unit were statistically significant factors in staffing, but INICIARE and Barthel Index were not related to staffing levels	**Strengths:** random selection of patients by medical record number Use of a training to generate internal consistency in data collection among the 157 nurses participating in data collection **Limitations:** data is cross-sectional so identifies a relationship but does not explain the nature of the relationship **Conclusion**: Hospital factors are correlated to nurse staffing levels whereas patient characteristics such as dependency and acuity are not.

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Tarazi, W. W. (2020). Associations between Medicaid expansion and nurse staffing ratios and hospital readmissions. *Health Services Research*, *55*(3), 375–382. https://doi.org/10.1111/1475-6773.13273 *This study demonstrates the variation in staffing based on economic differences (exo-level in model)*	Compare changes in nurse staffing and hospital readmission rates among hospitals in states that expanded Medicaid under the Affordable Care Act (ACA) to hospitals in non-expansion states	Hospitals that provided financial data to CMS from 2011 to 2016 Excluded hospitals in states with prior expansion and those who expanded after 2014 Total sample: 1403 hospitals in 20 expansion states and 2101 hospitals non-expansion states Expansion states: 31.9% were teaching hospital, <20% for profit or gov owned. Non-expansion: 15.8% teaching, 55% for profit or gov owned	Difference-in-difference design (which includes assumption of parallel trends) Linked data from CMS's Healthcare Cost Report Information System (HCRIS) to data on staffing in the AHA Annual Survey and data on Readmissions from the Hospital Compare website to determine % changes in productive nursing hours and readmissions per 10,000 patients Controlled for hospital size, type, location, teaching status Used data from 2011 through 2016 to capture before and after the 2014 implementation of the ACA	Before expansion: nonsignificant differences in staffing ratios and all cause readmission over 3 years Three years after expansions: nurse staffing ratios increased by 18% in expansion states and by 6.2% in non-expansion states. Readmissions decreased by 4.9% in expansion states and by 3.8% in non-expansion states Difference in difference model showed p <.001 comparing staffing in 2015 and 2016 between expansion and non-expansion states	**Strengths**: sample size, modeling that controlled for random and fixed effects **Limitations**: HCRIS data has quality issues, cannot control for misrepresented data; the hospital characteristics in the two groups were significantly different at baseline; study only looked at 3 years post expansions, a longer time frame and including more dependent variables is needed **Conclusion:** Medicaid expansion was independently associated with increased staffing and decreased readmissions. Authors hypothesize that improved revenues with Medicaid reimbursement contributed to those changes.

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Dall, T. M., Chen, Y. J., Seifert, R. F., Maddox, P. J., & Hogan, P. F. (2009). The economic value of professional nursing. *Medical Care*, *47*(1), 97–104. https://doi.org/10.1097/MLR.0b013e3181844da8	Quantify value of professional nursing care (noting that studies that look at "value of last hired RN" under-estimate that value)	Medical and surgical patients in nonfederal acute care hospitals Discharge data on 5.4 million discharges from 610 hospitals in 2005 Adding 133,000 RNs nationally would increase HPPD to 9.1 (75th percentile) in hospitals that at time of study were <9.1 and would also decrease hospital days by 3.6 million	Used literature review to establish relationship between nurse staffing and nurse sensitive outcomes (NSO) to calculate elasticity: the % change in complications for each 1% increase in hours per patient day (HPPD) of nursing care Used 2005 Nationwide Inpatient Sample and AHA data → multivariate regressions to correlate patient complications to mortality, LOS, and cost Modeled economic value by combining HPPD elasticity scores (for mortality and LOS) and direct calculation from literature synthesis	Strong elasticity → falls, HAP, UGIB, shock/cardiac failure, surgical UTI, and PI Modest elasticity→ pulmonary failure, ADE, postop infection, medical PI, and UTI, surgical DVT Weak elasticity→ CNS complications, sepsis, medical DVT Logistic regression: complications @ w/ increased inpatient mortality; 87% of lives saved by higher HPPD due to lower NSO, 13% due to better care Higher HPPD: 6.1billion in costs saved and 231million increase productivity w/ decrease in LOS; 1.3 billion productivity from averted deaths	**Limitations:** Age of the data, authors note risk of underestimating value because did not include administrative work that increases value of nursing (i.e., in billing); separate limitation- if complications decrease with existing staffing, the benefit of increasing staffing will also decrease with this modeling **Conclusions:** total cost savings of reduced LOS and increased productivity would account for 72% of the cost of hiring nurses to increase HPPD to 75th percentile. This does not consider human suffering • "*Current reimbursement systems {incentivize} staffing levels below where the benefit to society equals the cost to employ an additional nurse*" • The economic value of nursing is greater to payers than to individual facilities → payors have an incentive to ensure staffing is appropriate • 2009 article so asks- will value-based payment help

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Li, Y.-F., Wong, E. S., Sales, A. E., Sharp, N. D., Needleman, J., Maciejewski, M. L., Lowy, E., Alt-White, A. C., & Liu, C.-F. (2011). Nurse staffing and patient care costs in acute inpatient nursing units. *Medical Care*, *49*(8), 708–715. https://doi.org/10.1097/MLR.0b013e318223a9f1	Evaluate association between HPPD and skill mix and inpatient care costs in med/surg units, using VA data (past studies of nonfederal hospitals)	139,360 inpatient admissions to 292 med/surg units in 125 VA medical centers over a 5-month interval in 2003 21% surgical, 79% medical Independent variables- HPPD-total nursing hours, all skill levels and skill mix (% hours by RN) Dependent variables – inpatient costs per admission (CPHA) and costs per bed day of care (CPBDC)	Retrospective cross-sectional study, VA data Two step multivariable analysis: same dependent variables- CPBDC and CPHA for both steps Step 1-regression of observed cost on pt risk, facility, and market characteristics, including DRG weight Step 2- regression of nursing HPPD and RN skill mix Generated a multilevel mixed model	Surgical average CPHA- $18,642 and average CPBDC $2998 Medical average CPHA- $6636 and average CPBDC $1350 Total nursing HPPD- 7.3 for surgical and 7.1 for medical, with 61.9% care by RN for surgical and 60.2% for medical Surgical: Higher skill mix and a greater total HPPD were not associated with CPHA, but were associated with a higher CPBDC Medical: higher skill mixes not associated but higher HPPD was associated with higher CPHA; skill mix and HPPD both associated with higher CPBDC	**Limitations:** Cross sectional, may not be generalizable to non-VA settings Used admitting unit staffing and some patients moved about Classified as med vs surg based DRG **Strengths:** VA data provided more accurate calculation of HPPD, and they measured staffing at unit not hospital level **Conclusions:** Medical and surgical are different, partly due to ICU use and LOS For medical and surgical patients, higher skill mix was not associated with higher CPHA CPBDC may not be an effective measure of staffing and inpatient cost because the cost savings of better staffing is in LOS, not in the per day cost of admission

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Martsolf, G. R., Auerbach, D., Benevent, R., Stocks, C., Jiang, H. J., Pearson, M. L., Ehrlich, E. D., & Gibson, T. B. (2014). Examining the value of inpatient nurse staffing: An assessment of quality and patient care costs. *Medical Care*, *52*(11), 982–988. https://doi.org/10.1097/MLR.0000000000000248	Explore cause/ effect relationship between nurse staffing and care quality and inpatient care costs	18,474,860 Discharges from California, Nevada, and Maryland 1/3rd Medicare, 1/3rd private payor, 1/4th Medicaid, 1/10th self-pay 49.3% of admissions originated in ED	Longitudinal analysis using hospital nurse staffing data and the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases from 2008-2011 Fixed Effect Model – control for confounders Variables: # of licensed nurses per 1000 inpatient days, total nursing staff (licensed and UAP) per 1000 days; % of staff that was licensed and % of staff that was RN Outcomes: adverse events (AE), LOS, patient care cost Measured changes in patient level outcomes as related to changes in staffing in a given hospital, year to year	Model 1: (Licensed nurses) increased nurse staff associated with reduced AE and LOS, but no change in cost Model 2: (all staffing) increased staff associated with reduced AE and LOS, no cost change No difference between med and surg, no association with skill mix If hospitals moved from mean to 75th percentile (increase from 6.3 licensed nurses per 1K days to 7 per 1K days)- LOS decrease and nurse sensitive indicators improve; no change in cost Increasing % RNs- reduces cost but not LOS or AE	**Limitations:** used hospital charges for care cost, 78% of discharges were in California, looked at staffing at the year level so can't specifically correlate to each discharge, small effect size with adverse events, did not measure unique contribution of nurses, did estimate the effect of staffing while holding cost constant in a single regression **Conclude:** Increases in staff number and skill mix can lead to improved quality and reduced LOS without increased cost (in hospital charges)

Author, Year	Purpose	Sample & setting	Methods, Design Interventions, Measures	Results	Discussion, Interpretation, Limitation of Findings
Needleman, J., Buerhaus, P. I., Stewart, M., Zelevinsky, K., & Mattke, S. (2006). Nurse staffing in hospitals: Is there a business case for quality? *Health Affairs*, *25*(1), 204–211. https://doi.org/10.1377/hlthaff.25.1.204	Business case for nurse staffing: Study calculates the cost of increasing hospital nurse staffing and the impact and cost savings for LOS, mortality, and adverse outcomes	Discharge summaries and nurse staffing data from 799 nonfederal hospitals in 11 states Regression analysis previously done showed staffing correlation to LOS, mortality, and a variety of adverse outcomes (different for med and surg pops)	Simulation: the effect of increasing nurse staffing three ways: 1. By increasing the portion of hours of RN care to 75th percentile (and not changing total hours); 2. Increasing the licensed hours to the 75th percentile 3. Raise staffing to 75th percentile in all hospitals currently below that level Estimated variables costs at 40% of average costs Compared cost of hiring staff to the cost savings of avoided AE and lower LOS. Change in LOS accounted for 90% of cost savings – did not calculate cost of mortality	Increasing the proportion of nursing hours provided by RN without changing total nursing hours→ net reduction in costs (-0.5%) Increasing licensed hours of care to 75th percentile with same proportion of RN→ reduces LOS, death, and adverse outcomes but a net increase in costs of 0.8% Increasing licensed hours AND proportion of RN care to 75th percentile→ net cost of 0.4%	**Limitations**: age of study may affect applicability now and financial modeling (may not consider the cost benefit of avoided adverse outcomes under current Medicare rules) Authors note- they do not quantify cost of deaths, patient suffering, or benefits such as patient satisfaction and reduced turnover that higher staffing might bring **Strength:** compared their results to those that would be found with data from other studies to validate findings **Conclusions:** • There is unequivocal business case for shifting to more licensed hours of care by RN • Increasing total licensed hours at same portion of RN hours, reduces LOS but less impact on adverse events and deaths • Increasing both total and RN hours, reduces adverse outcomes, LOS, and deaths and has a cost

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