From Payer to Patient: A Multi-Method Investigation into the Intersection of Financial Incentives and Healthcare Organizational Characteristics towards Improved Quality Outcomes

FROM PAYER TO PATIENT: A MULTI-METHOD INVESTIGATION INTO THE INTERSECTION OF FINANCIAL INCENTIVES AND HEALTHCARE ORGANIZATIONAL CHARACTERISTICS TOWARDS IMPROVED QUALITY OUTCOMES

by

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ABSTRACTS

Abstract Article 1: Beyond Medical Necessity: A Multi-Level Systems Analysis of Emergency Department Admissions

Background: Inpatient hospital care constitutes the largest proportion of healthcare expenditures within the United States. While admission decisions are generally ascribed to clinical acuity, discretionary admissions frequently occur at the nexus of medical necessity and organizational considerations. This study endeavors to quantify the impact of multi-level system factors on the clinical decision-making process regarding patient admissions from the Emergency Department (ED).

Material and Methods: We conducted a retrospective cross-sectional analysis of ED encounters in Florida during 2017. Data were integrated from the Florida Agency for Health Care Administration, the American Hospital Association, and the Centers for Medicare & Medicaid Services. To focus on discretionary decision-making, we filtered for encounters within a "discretionary zone" where admission rates for specific diagnosis-related groups ranged from 10% to 90%. A multivariate logistic regression model was employed, utilizing the Bayesian Information Criterion (BIC).

Results: While clinical indicators, including age and comorbidity, remained the primary predictors, organizational factors exerted significant influence. Insurance, hospital ownership, and hospital occupancy were major contributors to the disposition decision. Notably, patients at for-profit institutions and those with certain insurance profiles showed significantly higher odds of admission.

Conclusions: Organizational structure and systemic incentives significantly influence ED admission decisions beyond patient clinical status. These findings provide policymakers with a quantitative basis for addressing institutional biases in care delivery.

Abstract Article 2: Beyond Outcomes: Incorporating Organizational Complexity into Value-Based Purchasing Design

Current Value-Based Purchasing (VBP) models undertake a generalized approach to financial incentives that fails to account for hospital organizational complexity. Organizational Mediation Hypothesis proposes that a hospital's institutional architecture, which includes its governance, resource depth, and clinical structure, functions as a powerful bias upon the influence of financial incentives. Specifically, factors such as cognitive disconnect, structural distortion, and internal alignment determine whether influences support enhanced or diminished results toward improving clinical quality. This inquiry employs a theoretical framework integrating agency theory and bounded rationality alongside a narrative review of peer-reviewed studies to evaluate the relationship between organizational traits and clinical quality.

The literature assessment identifies concerns that small incentives and multi-year lags between measurement and payment create a cognitive disconnect between cause and effect. Furthermore, a quality paywall exists where hospitals with limited capital struggle to invest in the infrastructure required for VBP success, potentially widening health inequities. To address these deficits, CMS should pilot an Organizational Complexity Index to adjust VBP penalties, as it does with Social Risk Factors. Stratifying peer groups by structural characteristics is essential to prevent VBP from remaining an incomplete, context-blind policy instrument.

Key Takeaways

- Current Value-Based Purchasing (VBP) models link financial payments to clinical performance and patient outcomes, yet these models rely on "one-size-fits-all" incentives that fail to account for hospital organizational complexity.
- Small financial incentives combined with a massive 10-year lag between measurement and actual payment create a diluted effect that fails to disrupt the noise of daily hospital operations.
- Structural barriers impede success, such as when hospitals lacking capital reserves cannot afford the infrastructure required to meet performance benchmarks. Without adjusting for organizational complexity, VBP may inadvertently widen health disparities while simultaneously failing to recognize best practices.

Abstract Article 3: The Evolution of Quality: A Case Study on Care Delivery Innovation and the Alignment of Value-Based Purchasing

Purpose: This study explores how Value-Based Purchasing (VBP) drives quality improvements in healthcare through systemic organizational transformation. By examining a novel home health program, the research investigates how quality-linked payments motivate infrastructure investment and process redesign to improve outcomes for medically complex pediatric patients.

Methodology: A qualitative case study was conducted using semi-structured interviews with 21 frontline nurses, 11 administrators, and 10 parents/guardians associated with the BAYADA Home Intensive Care Unit (HICU®) program. Data was analyzed using a deductive thematic approach, with inter-rater reliability to ensure methodological rigor.

Findings: Results indicate that VBPs catalyze organizational changes, including enhanced care coordination, robust investment in health information technology, and specialized workforce training. Participants identified "unmeasured" benefits beyond traditional metrics, such as improved family quality of life and the attainment of pediatric developmental milestones. While the program achieved a 25% reduction in rehospitalizations, challenges remain regarding the national nursing shortage and inconsistent payer participation.

Implications: Realizing the full potential of VBP requires a policy shift from financial incentives that target individual behaviors to those that support organizational improvements. Payers should adopt broader success metrics that capture the holistic progress of patients. Additionally, open data mandates are

recommended to increase transparency and support evidence-based investments in innovative care programs.

1 BEYOND MEDICAL NECESSITY: A MULTI-LEVEL SYSTEMS ANALYSIS OF EMERGENCY DEPARTMENT ADMISSIONS

1.1 INTRODUCTION

Inpatient hospital care represents the largest share of healthcare expenditures in the United States (Smulowitz et al., 2013). Yet, empirical evidence demonstrates that higher rates of hospital admission do not necessarily correlate with improved patient outcomes or reduced mortality (Coussens & Ly, 2025). Consequently, discretionary admissions often lead to high-cost, low-value care. The Emergency Department (ED) serves as the predominant entry point for these admissions, where more than 70% of all inpatient encounters originate (Nuckols et al., 2017). Because the ED is a fully integrated, hospital-controlled department, it serves as a critical operational junction where medical decisions and organizational objectives intersect.

Millions of ED encounters occur annually across the US, creating a massive volume of clinical decision points. Whether by ambulance or personal transportation, the ED acts as a health services destination for timely clinical care. At this interface, patients are either treated and discharged or admitted to the hospital for advanced care. A physician or supervised clinical provider performs a formal clinical assessment to determine appropriate care needs, a decision traditionally attributed to patient characteristics and clinical acuity. We know, for instance, that age and standard determinants of health have a quantifiable influence on the individual; current research confirms that each additional year of age increases the odds of admission (Fimognari et al., 2022). However, the patient interacts with the ED in a layered environment,

where throughput is affected by volume and staffing. Providers and resources are subject to varying administrative demands that can influence clinical workflows and judgment. Furthermore, the ED interacts with the hospital, which can constrain clinical decision-making through volume-related effects and limited access to specialized hospital care.

Emergency Departments are the primary source of admissions, but they are controlled by the hospital, and hospitals are often part of larger health systems. Patient disposition within the ED and subsequent hospital inpatient services are fundamentally intertwined operational issues, and discretionary admissions drive enhanced revenue for the organization. Beyond the hospital are system-level influences, including strategic investments in resources that support utilization. Further, these systems are subject to external influences, primarily the pursuit of revenue and adherence to insurance requirements. Operational reality demands that organizations maximize revenue to maintain stability, a principle that transcends ownership structure; even charitable organizations must secure resources to remain viable. External pressures are evident in the managed care market, where insurers optimize financial positions by minimizing medical expenditures through reduced utilization. This creates a wide-ranging world of influences and layers that interact and affect one another.

Current literature and analysis on ED to hospital transitions focus almost exclusively on clinical measures and patient demographics, often ignoring the context of the delivery site (Larburu et al., 2023). We challenge this conventional assumption and instead propose that admission decisions are also incrementally associated with organizational and systemic levers. Specifically, even after controlling for patient

demographics and clinical severity, we determine that variables such as hospital ownership, bed capacity, and payer status are robust, independent predictors of admission status. This suggests that the medical decision is, in reality, a composite outcome shaped significantly by the extended context of the delivery site.

1.2 SYSTEMS THEORY

Investigating hospital admissions through the lens of Emergency Department encounters requires a theoretical framework that goes beyond simple linear causality. While traditional medical models prioritize clinical indications as the sole determinant of care, this research posits that the decision to admit is embedded within a complex, multi-layered ecosystem. To accurately capture these dynamics, we apply Systems Theory as the overarching theoretical lens. EDs and their physicians do not operate in isolation when providing care. Rather, they function within an "open system" that must continuously interact with its environment *(von Bertalanffy, 1968)*. Under this paradigm, organizational viability depends on the successful inflow and outflow of resources, including patients, payments, and personnel, to achieve a steady state. This perspective allows us to understand how layered environmental pressures, such as teaching hospital status and insurance market dynamics, filter down through the organization to explain individual clinical encounters.

To dissect these influences, we apply specific theories to each level of the healthcare hierarchy, moving from the individual patient to the broader external environment. Traditionally, clinical factors explain variability at the most granular level. Here, the standard medical model applies, in which patient characteristics such

as age and comorbidities (e.g., Elixhauser score) drive decision-making. However, even at this level, Systems Theory suggests that these "inputs" are processed through an organizational structure that may weigh them differently depending on capacity constraints.

Donabedian's Structure-Process-Outcome (SPO) model provides the best understanding of the interaction between the ED and the hospital. Donabedian defines structure as “the setting in which care takes place,” including material resources and administrative organization (Donabedian, 1966, 1988). In this study, we treat the admission decision as an early, measurable "process" output. The SPO model elucidates how structural features such as hospital size, ownership type, and teaching status shape the *process* of care delivery, thereby influencing the decision to admit. For instance, a hospital’s bed capacity (*structure*) directly constrains or enables the ED physician's ability to admit (*process*).

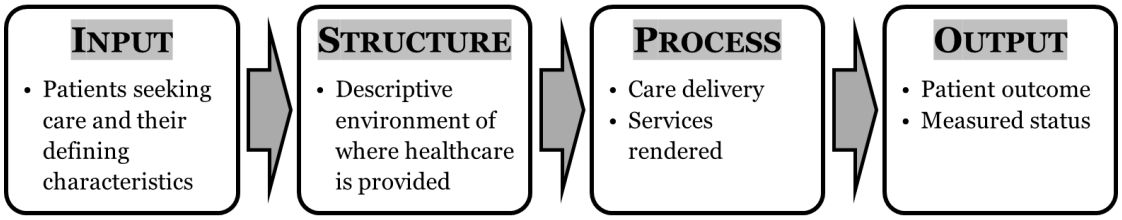

Figure 1.1: Donabedian’s Structure-Process-Outcome

At the organizational level, Resource Dependence Theory (RDT) provides a framework for understanding hospital-system behavior. RDT suggests that organizational survival is predicated on the ability to manage environmental uncertainty by securing essential external resources (Pfeffer & Salancik, 1978). For

hospitals, these critical resources include a consistent patient volume and the physician gatekeeping function.

Because the physician's decision to admit represents the primary mechanism for revenue generation, hospitals utilize vertical integration (such as acquiring physician practices) to internalize this clinical decision-making process. By transitioning physicians from external partners to internal employees, the organization reduces its dependence on an unpredictable market and stabilizes its core revenue-generating activity (Walker et al., 2018).

While resource acquisition is fundamental to institutional viability, the pursuit of financial margins often serves as a transformative catalyst for organizational behavior. A relentless focus on profitability creates reinforcing feedback loops, in which systems prioritize expanding high-margin service lines while simultaneously contracting those that are financially non-viable. In nonprofit organizations, these financial imperatives may precipitate strategic shifts that deviate from foundational clinical missions. This dependence on external resources fosters a dual-layered conflict: internal competition for capital allocation and external rivalry for market share. These dynamics are further complicated by payers who optimize their own financial positions by minimizing medical expenditures, creating a complex ecosystem of misaligned incentives. The layers, as depicted in ***Figure 1.2,*** add context that mediates and moderates the original ED-patient interaction.

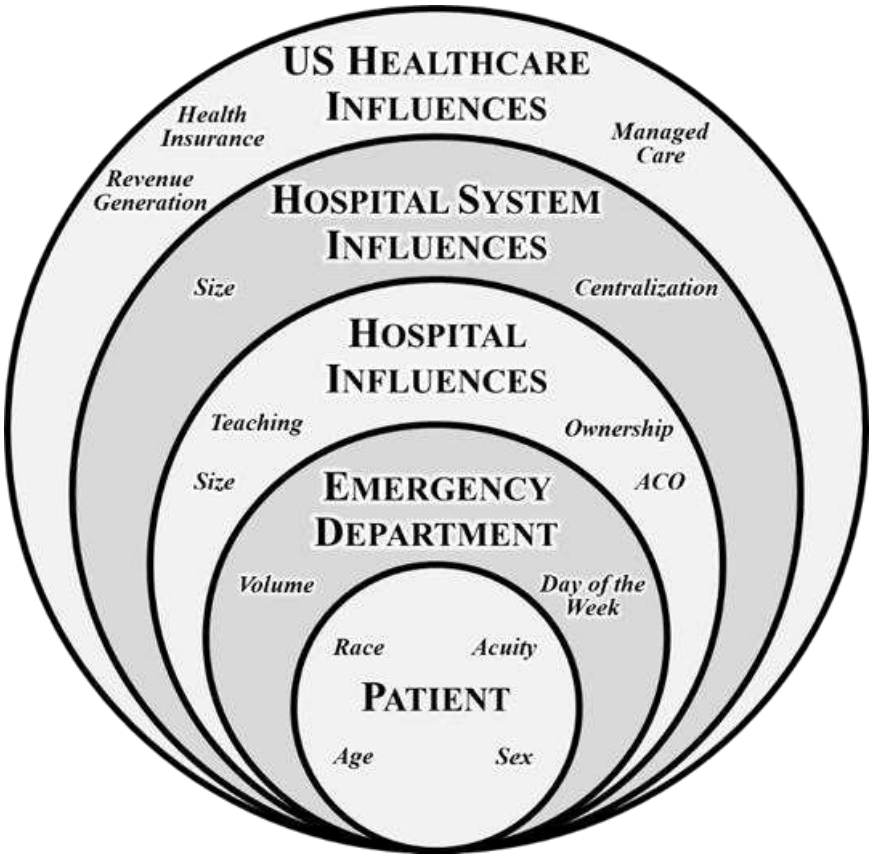

Figure 1.2: Layered Context of Influences on Emergency Department Admissions

The external environment is shaped by market forces and regulatory pressures, where Systems Theory again provides the context. External entities, such as insurers (e.g., Medicare Advantage plans), exert pressure on the system by optimizing their financial positions by denying claims and imposing prior authorizations. The hospital, as an open system, must adapt to external constraints, such as varying reimbursement rates (e.g., commercial vs. Medicare), which ripple through the organization, influencing protocols and, ultimately, the patient's disposition decision in the ED.

1.3 Experiment and Methods

To transcend from theoretical framework to empirical observation, this study operationalizes these multi-level influences through a large-scale, retrospective analysis. The research design allows for a quantitative assessment of the impact on the clinical process. The methodology outlines how hospital, financial, and patient data were aggregated and specifically filtered to isolate the discretionary zone of hospital admissions. This approach provides a rigorous statistical method for testing the hypothesis and determining the extent to which layered influences significantly affect the patient admission process.

1.3.1 Study Design

A retrospective, observational study was conducted using encounter-level data from calendar year 2017. Information was aggregated from multiple administrative databases to capture a comprehensive view of Emergency Department (ED) encounters and subsequent hospital admissions. The primary data source was the Florida Agency for Health Care Administration (AHCA), which provided the Hospital Inpatient Discharge Data and the Ambulatory and Emergency Department Patient Data Set (Florida Agency for Health Care Administration, 2017c, 2017a).

To contextualize the organizational and financial environments of the facilities, the AHCA datasets were linked with the 2017 American Hospital Association (AHA) Annual Survey database, which supplied descriptive profiles of 268 Florida hospitals (American Hospital Association, 2018). Additionally, the 2017 Centers for Medicare & Medicaid Services (CMS) Provider Utilization and Payment Public Use File was

used to create proxy variables for inpatient revenue. Strict criteria for academic medical centers were established using the 2017 CMS Open Payments Teaching Hospital List.

Initial dataset mapping yielded over 10.6 million ED encounters. However, an exploratory analysis of conditional certainty revealed that a large proportion of patient dispositions were clinically predetermined. For instance, certain primary diagnoses, such as unspecified acute upper respiratory infections, were almost never linked to admission (less than 0.5%), whereas presentations such as full-term uncomplicated deliveries resulted in admission nearly 100% of the time (see ***Figure 1.3***).

To rigorously test our central hypothesis, it was critical to exclude encounters where clinical acuity overwhelmingly dictated the disposition. Therefore, we specifically restricted the analytical dataset to ED encounters with primary diagnosis codes demonstrating an admission rate between 10% and 90%. This specific filtering strategy isolates the "discretionary zone" of medical decision-making. By focusing exclusively on this high-variability cohort, the study establishes a methodological framework in which non-clinical factors have the greatest influence on the final decision. This approach successfully reduces clinical noise, leaving a refined sample of observations where organizational and systemic levers can be measured against clinical necessity.

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optimal subpopulation average treatment effect framework established by Crump et al. (2009). By filtering observations with conditional probabilities of the outcome outside the [0.1, 0.9] range, we focus the analysis on the subpopulation that minimizes the variance of the estimator, thereby ensuring robust identification of variable effects.

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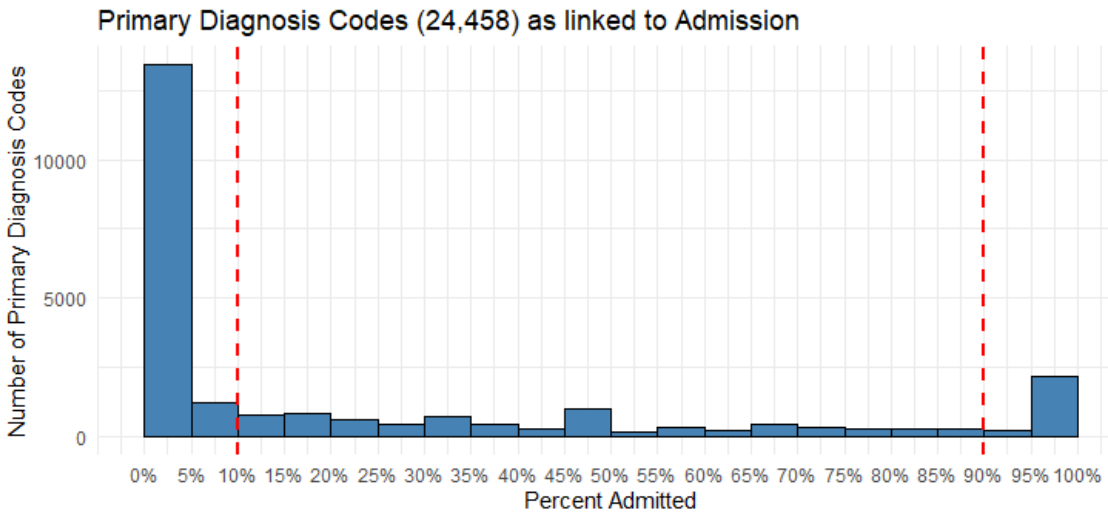


Figure 1.3: Probability of Admission Defined Exclusively by Primary Diagnosis Codes

Table 1.1: Characteristics of the Analyzed Population

			Full ED Data		Restricted Clinical Variability (10-90)	
	Variable		**n**	**Percent**	**n**	**Percent**
	Total Population		10,659,633		4,051,587	
	Admitted	No	8,788,827	82.4%	2,624,649	64.8%
		Yes	1,870,806	17.6%	1,426,938	35.2%
P	Age (mean, SD)		41.3(±25.0)		49.7 (±24.6)	
a	Sex	Male	4,664,489	43.8%	1,830,380	45.2%
t		Female	5,995,144	56.2%	2,221,207	54.8%
i	Race	White	7,103,249	66.6%	2,870,493	70.8%
e		Black	2,582,225	24.2%	856,736	21.1%
n		Other	974,159	9.1%	324,358	8.0%
t	Ethnicity	Non-Hispanic	8,446,716	79.2%	3,285,658	81.1%
		Hispanic	2,212,917	20.8%	765,929	18.9%
	Elixhauser Comorbidity Score (mean, SD)		13.3(±23.5)		13.0 (±20.7)	
H	Weekday	Sunday	1,450,944	13.6%	526,786	13.0%
o		Monday	1,654,683	15.5%	628,453	15.5%
s		Tuesday	1,580,233	14.8%	608,376	15.0%
p		Wednesday	1,550,349	14.5%	597,726	14.8%
i		Thursday	1,515,501	14.2%	586,326	14.5%
t		Friday	1,491,237	14.0%	580,762	14.3%
a		Saturday	1,416,686	13.3%	523,158	12.9%
l	Month	January	946,006	8.9%	362,603	8.9%
		February	879,101	8.2%	330,284	8.2%
		March	951,683	8.9%	359,406	8.9%
		April	899,572	8.4%	339,376	8.4%
		May	902,980	8.5%	343,855	8.5%
		June	832,331	7.8%	322,460	8.0%
		July	861,713	8.1%	333,545	8.2%
		August	870,489	8.2%	336,052	8.3%
		September	844,991	7.9%	327,020	8.1%
		October	890,792	8.4%	337,567	8.3%
		November	887,482	8.3%	334,376	8.3%
		December	892,493	8.4%	325,043	8.0%
	Teaching Hospital	No	5,595,522	52.5%	2,122,663	52.4%
		Yes	5,064,111	47.5%	1,928,924	47.6%
	ED annual volume (/1000)		11.3(±14.1)		11.3 (±14.1)	
	Beds /100 staffed (mean, SD)		5.9(±6.7)		6.1 (±6.8)	
	Hospital Occupancy % (mean, SD)		56.3(±24.9)		56.9 (±24.4)	
	Ownership	Government	1,662,534	15.6%	656,831	16.2%
		Non Profit	5,315,005	49.9%	2,050,197	50.6%
		For-Profit	3,682,094	34.5%	1,344,559	33.2%
	ACO	No	6,818,075	64.0%	2,545,590	62.8%
		Yes	3,841,558	36.0%	1,505,997	37.2%
S	System Beds / 1000 (mean, SD)		4.2(±3.7)		4.1 (±3.7)	
y	System Control	Undefined	1,974,170	18.5%	785,013	19.4%
s		Centralized	1,045,458	9.8%	409,562	10.1%
t		Central Physician	149,230	1.4%	52,226	1.3%
e		Mod. Central	1,544,758	14.5%	581,339	14.3%
m		Decentralized	5,910,007	55.4%	2,215,603	54.7%
		Independent	36,010	0.3%	7,844	0.2%
E	Insurance	Commercial	2,571,362	24.1%	918,532	22.7%
x		Medicaid	499,175	4.7%	170,872	4.2%
t		Managed Medicaid	2,542,688	23.9%	697,576	17.2%
e		Medicare	1,558,738	14.6%	892,287	22.0%
r		Medicare Advantage	1,116,610	10.5%	614,050	15.2%
n		Other	720,495	6.8%	233,224	5.8%
a		Self-Pay	1,650,565	15.5%	525,046	13.0%
l	Admission payment estimate (/$1000)		7.2(±2.8)		7.3 (±3.0)	

1.4 VARIABLES

The dependent variable was a binary outcome indicating whether the ED encounter resulted in a hospital admission. Independent variables selected for this study were categorized to align with the multi-level theoretical framework, capturing influences ranging from individual clinical need to broad environmental pressures.

1.4.1 Patient Variables

To account for clinical necessity and individual risk, the model included foundational demographic and health status indicators. These consisted of age, sex, race, and ethnicity. The primary measure of clinical acuity and patient complexity was the Elixhauser Comorbidity Score, a numeric index calculated for each encounter based on all patient-level diagnostic codes. These variables represent the essential "inputs" of the clinical encounter and serve as the primary controls for medical necessity.

1.4.2 Hospital Variables

Facility-level structural and operational factors were included to capture the immediate environment in which the admission decision occurs. These variables included teaching status, hospital ownership type (categorized as Government, Nonprofit, or For-profit), and participation in an Accountable Care Organization (ACO). Internal capacity and scale were measured using the number of staffed beds and the hospital occupancy percentage. Additionally, to account for temporal fluctuations, the model included the specific weekday and the month of the ED encounter.

1.4.3 Health System Variables

Because many hospitals operate as subsidiaries within larger corporate entities, the model incorporates variables reflecting health system characteristics. To capture the scale and influence of these organizations, the total number of system beds is included as a validated indicator of the parent organization's overall capacity, resource reach, and market power (Büchner et al., 2016).

To operationalize the degree of centralization in decision-making, health systems were categorized into five distinct clusters as defined by the AHA annual survey responses based on their organizational structure for hospital services, physician arrangements, and insurance product development. These clusters identify the extent to which strategic and operational choices are made at the system level versus the local facility level.

Centralized Health System: Defined by high levels of vertical integration where the parent organization exercises direct, uniform control over hospital operations, physician contracting, and the development of insurance products.

Centralized Physician/Insurance Health System: A model characterized by a "split" governance logic: physician arrangements and insurance risk management are tightly managed at the system level, while individual hospitals retain significant decentralized authority to tailor their clinical service lines to local demand.

Moderately Centralized Health System: A hybrid or tiered approach to centralization. High-capital or complex service lines are managed through a central authority to leverage economies of scale, whereas routine health services remain decentralized to ensure facility-level flexibility.

Decentralized Health System: A system with a high degree of facility-level independence, often necessitated by high product differentiation across the network. In this structure, the central entity functions primarily as a support hub for information sharing and administrative oversight rather than an operational command center.

Independent Hospitals: These hospitals maintain the highest levels of operational independence, with little or no parent organization framework for collaboration between otherwise self-governing hospitals.

1.4.4 External Variables

Factors external to the clinical and organizational structure were included to represent the broader market and financial environments. The insurance payer type (e.g., Commercial, Traditional Medicare, Medicare Advantage, Medicaid, or Self-pay) was captured at the individual encounter level; however, these values are conceptually linked to the macro-level reimbursement landscape. By recording the specific coverage for each patient, the model accounts for how broad external financial incentives and "payer mix" pressures manifest within individual clinical interactions.

Additionally, the model utilized an admission payment estimate as a numeric proxy for potential inpatient revenue. While calculated for each encounter, this estimate is derived from systemic data, weighting primary diagnosis codes based on their historical MS-DRG frequency and Medicare reimbursement rates. Together, these encounter-level observations allow the study to quantify the resource dependencies that influence institutional behavior, illustrating how systemic financial signals are translated into localized disposition decisions.

Equation 1.1: Model Equation

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_{\text{Age}}\text{Age} + \beta_{\text{Sex}}\text{Sex} + \beta_{\text{Race}}\text{Race} + \beta_{\text{Eth}}\text{Ethnicity} + \beta_{\text{Elix}}\text{Elixhauser} + \sum_{i=1}^{6}\beta_{\text{Wk},i}\text{Weekday}_i + \sum_{j=1}^{11}\beta_{\text{Month},j}\text{Month}_j + \beta_{\text{Tch}}\text{Teaching} + \sum_{\text{k}=1}^{2}\beta_{\text{Own,k}}\text{Ownership}_{\text{k}} + \beta_{\text{ACO}}\text{ACO} + \beta_{\text{Beds}}\text{Bed} + \beta_{\text{Occ}}(\text{Occupancy} - \bar{x}) + \beta_{\text{Occ2}}(\text{Occupancy} - \bar{x})^2 + \sum_{l=1}^{5}\beta_{\text{Cent},l}\text{System Centralization}_l + \beta_{\text{SysBed}}\text{System Beds} + \sum_{m=1}^{7}\beta_{\text{Pay},m}\text{Payer}_m + \beta_{\text{DRG}}\text{DRG Payment} + \varepsilon$$

1.5 STATISTICAL ANALYSIS

A multivariate logistic regression approach was employed to estimate the contribution of each independent predictor to the log-odds of the binary admission outcome. Because the restricted dataset still contained over 4 million observations, traditional generalized linear models exceeded computational memory limits of standard desktop computers. Consequently, the analysis was executed in RStudio (version 4.4.3) using the *bigglm* package, which relies on a memory-efficient iterative algorithm designed for high-volume data.

Rigorous diagnostic testing was conducted to ensure the model's statistical reliability and to verify key assumptions. The assumption of independence was satisfied by treating each ED encounter as a discrete event with a single, independent outcome. Even if patients experienced multiple ED visits throughout the year, each

visit was modeled as a distinct observation with its own immediate environmental and clinical context. Model Diagnostics and Residual Analysis are included in

Appendix 1.5.

The assumed absence of severe multicollinearity was continuously monitored using the Variance Inflation Factor (VIF). Initial iterations revealed highly inflated correlations between annual ED visit volume and the number of staffed hospital beds. To resolve this, the ED visit volume variable was removed because staffed beds provided superior predictive power. Furthermore, a structural multicollinearity risk between the linear occupancy rate and its quadratic term was neutralized by mean-centering the occupancy variable.

The Relative Variable Importance to the full model was evaluated using iterative variable elimination, as measured by BIC, as well as the Standardization / L^2 Norm (Euclidean Norm) approach. Backward elimination followed an iterative pruning logic, removing one variable from the full model and comparing and ordering the impact on the BIC. Whereas, in the standardization approach, all variables were converted for cross-comparison to represent one standard deviation per unit. Categorical variable importance was calculated from the root of the sum of squares for all coefficient dummy levels (L^2 Norm). Subsequent values were ranked to identify hierarchical impact on model prediction. To quantify the relative importance of each predictor, we utilized the change in BIC, where absolute differences greater than 10 are considered 'very strong' evidence for a variable's contribution (Raftery, 1995). We subsequently calculated impact ratios by comparing the proportional change in BIC for one variable with that for another.

1.6 RESULTS

Retrospective cross-sectional analysis of 4,051,587 Florida Emergency Department encounters assessed the predictors of hospital admission through a systematic modeling approach. Variables were added sequentially in accordance with Systems Theory, progressing from individual patient characteristics to the hospital level, then to the health system level, and finally to external environmental factors. The incremental inclusion of these layered variables significantly enhanced the model's explanatory capacity. Model validity and the relative significance of variables were evaluated by examining their impact on the Bayesian Information Criterion (BIC) and the corresponding odds ratios (ORs). The specific numerical values of ORs and standard deviations by model are provided in ***Table 1.2***.

1.6.1 Patient

Clinical and demographic patient-level factors emerged as the foundational explanatory variables for admission. The patient's age and clinical complexity were the most dominant predictors overall, demonstrating the largest relative impacts on the BIC. Age showed a powerful influence in the model, with each additional year increasing the odds of admission by 3.1% (OR: 1.031). Clinical severity, measured by the Elixhauser Comorbidity Score, was associated with a 1.4% increase in admission odds with each point increase.

Demographic variables were also statistically significant but demonstrated lower relative importance to the model's overall fit. Female sex was associated with a 20% decrease in the odds of admission (OR: 0.801), while Hispanic ethnicity was

associated with lower odds (OR: 0.937). Most notably, Black race initially showed no significant influence but became statistically significant with a restrictive OR of 0.990 after the inclusion of hospital and system-level controls.

This transition reveals a suppression effect, suggesting that organizational characteristics previously masked an underlying racial disparity. By holding health system scale and centralization constant, the model isolates institutional processes from structural access. These results show that within the discretionary zone of medical decision-making, Black patients experience a statistically lower likelihood of admission, a finding that represents a substantial systemic impact when scaled across a dataset of millions of observations.

1.6.2 Hospital

Facility-level structural and operational variables significantly influenced the likelihood of admission, indicating that the immediate care environment both restricts and enables clinical decisions. Total hospital occupancy was a highly robust predictor, yielding a substantial impact on the BIC. While a single percentage point increase in occupancy showed a minor baseline effect (OR: 1.007), the cumulative impact of a 30% variance in occupancy resulted in a 23% increase in the odds of admission. Hospital ownership type also played a major role; for-profit facilities were associated with a 58.4% higher likelihood of admission than government facilities. This effect size increased from a 1.396 OR as external interactions were fully incorporated.

Operational capacity, measured by staffed beds, was positively associated with admission; every 100 additional beds increased the odds by 1.6%. Academic teaching status was associated with an increased odds of admission (OR: 1.075). Finally,

participation in an Accountable Care Organization (ACO) showed a statistically significant protective reduction in admission odds when initially introduced, but this effect reversed after adding system and external influences (OR: 1.051).

Expanding beyond the distinct facility, the model captured the influence of broader health system characteristics. The centralization of decision-making within the parent health system proved to be an important structural predictor, contributing a meaningful reduction to the BIC. Organizations that self-identified as centrally controlled were associated with a reduced OR of 0.747. Additionally, the parent organization's overall scale, measured by the total number of system beds, contributed to the model. These findings indicate that local facility decisions are measurably impacted by the strategic structure and operational size of the overarching corporate entity.

Factors external to the clinical and organizational boundaries highlighted the critical role of resource dependence and market environments. The patient's insurance payer type was the most influential non-clinical predictor overall, based on its impact on the BIC. Compared with the commercial insurance baseline, traditional Medicare and Medicaid patients had substantially higher odds of admission (ORs: 1.489 and 1.277, respectively). Conversely, self-pay patients had a 22.1% lower likelihood of admission.

The financial incentive structure, proxied by the estimated average DRG payment, was also a highly significant predictor of admission. For every $1,000 increase in potential inpatient DRG payment, the odds of admission increased by

5.1%. This confirms that external financial viability is strongly associated with admission.

Table 1.2: Model Comparison with Layered Influences

	Patient	+Hospital	+System	+External
Term	OR, Signif, SD	OR, Signif, SD	OR, Signif, SD	OR, Signif, SD
Patient				
Age (Years)	1.031*** (0.000)	1.031*** (0.000)	1.031*** (0.000)	1.026*** (0.000)
Sex: (Ref: Male)				
Female	0.794*** (0.002)	0.793*** (0.002)	0.795*** (0.002)	0.801*** (0.002)
Race (Ref: White)				
Black	1.001 (0.003)	0.981*** (0.003)	0.981*** (0.003)	0.990*** (0.003)
Other	0.899*** (0.004)	0.885*** (0.005)	0.873*** (0.005)	0.889*** (0.005)
Ethnicity (Ref: Non-Hispanic)				
Hispanic	0.901*** (0.003)	0.893*** (0.003)	0.916*** (0.003)	0.937*** (0.003)
Elixhauser Comorbidity Score	1.015*** (0.000)	1.015*** (0.000)	1.015*** (0.000)	1.014*** (0.000)
Hospital Factors				
Teaching Hospital (Ref: No)				
Yes		1.092*** (0.003)	1.069*** (0.003)	1.075*** (0.003)
Hospital Ownership (Ref: Gov't)				
Non Profit		1.036*** (0.003)	1.068*** (0.003)	1.051*** (0.003)
For-Profit		1.396*** (0.004)	1.605*** (0.005)	1.584*** (0.005)
Accountable Care Organization (Ref: No)				
Yes		0.973*** (0.003)	1.038*** (0.003)	1.051*** (0.003)
Staffed Hospital Beds (/100)		1.014*** (0.000)	1.016*** (0.000)	1.016*** (0.000)
Rate of Occupancy[t] (Percent 0-100)		1.006*** (0.000)	1.007*** (0.000)	1.007*** (0.000)
Rate of Occupancy^2		1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)
Hospital System				
System Centralization (Ref: Undetermined)				
Centralized			0.747*** (0.005)	0.744*** (0.005)
Centralized Physician			0.759*** (0.011)	0.733*** (0.011)
Mod. Central			1.071*** (0.004)	1.070*** (0.004)
Decentralized			0.890*** (0.004)	0.896*** (0.004)
Independent			1.073* (0.032)	0.967 (0.032)
System Staffed Beds (/1000)			0.988*** (0.001)	0.989*** (0.001)
US Healthcare (External)				
Insurance (Ref: Commercial)				
Medicaid				1.277*** (0.006)
Managed Medicaid				1.011** (0.004)
Medicare				1.489*** (0.004)
Medicare Advantage				1.252*** (0.004)
Other				1.247*** (0.005)
Self				0.779*** (0.004)
Admission payment estimate (/$1000)[tt]				1.051*** (0.000)
Constant	0.104*** (0.004)	0.088*** (0.007)	0.091*** (0.007)	0.074*** (0.008)
Weekday		Fixed	Fixed	Fixed
Month		Fixed	Fixed	Fixed
BIC	4765364	4723445	4715454	4674459
N	4051587	4051587	4051587	4051587

Statistical Significance * p<0.05, **p<0.01, ***p<0.001

[t]Occupancy Rate is Centered to avoid multicollinearity concerns

[tt]Traditional Medicare Payment Averaged by DRG specific to Florida

1.7 Relative Variable Importance by Model Layer

Predictors were assessed using Relative Variable Importance, with the change in BIC as each variable was iteratively removed from the full model. The results, summarized in ***Table 1.3***, demonstrate relative impact on the model's explanatory power. The variable importance, as evaluated by variable standardization, contributed similar insight and is included in ***Appendix C***.

The model's foundational layer proved to be the most dominant determinant of the outcome. Age was the single most influential variable in the entire analysis, yielding a BIC reduction of -138,844. This was followed by the Elixhauser Comorbidity Score (ΔBIC = -56,737), underscoring that biological risk and existing health burden are the primary drivers of the outcome. However, demographic factors had a relatively minor influence, with Ethnicity having an impact ratio to Age of just 0.003.

The addition of hospital-level operational and structural factors provided the next tier of explanatory power. Within this layer, Rate of Occupancy emerged as the leading predictor (ΔBIC = -18,538), suggesting that facility capacity constraints significantly influence the outcome. Hospital Ownership was also a key differentiator (ΔBIC = -12,212), indicating that distinctions among for-profit, nonprofit, and government ownership structures play a substantial role. The system-level layer, which encompasses the hospital's broader organizational network, showed a more concentrated impact. System Centralization, the degree to which decision-making is centralized within a health system, was the primary driver, with a BIC change of -6,189.

The final layer, representing external US Healthcare and financial pressures, demonstrated remarkably high importance, rivaling the clinical predictors in the first layer. Insurance status was the third most important variable in the overall model (ΔBIC = -22,912). Additionally, the Admission payment estimate was highly influential, ranking in the top third of variables.

Table 1.3: Relative Variable Importance by Change in BIC

Variable	BIC Delta	Layer
Age	-138844	Patient
Elixhauser Comorbidity Score	-56737	Patient
Insurance	-22912	External
Rate of Occupancy	-18538	Hospital
Admission payment estimate	-17454	External
Hospital Ownership	-12212	Hospital
Sex	-9576	Patient
System Centralization	-6189	System
Staffed Hospital Beds	-3613	Hospital
Teaching Hospital	-750	Hospital
Race	-632	Patient
System Staffed Beds	-415	System
Ethnicity	-386	Patient
Month	-381	Hospital
Accountable Care Organization	-288	Hospital
Weekday	11	Hospital

1.8 DISCUSSION

This analysis is intended to identify factors associated with the conversion of ED visits to inpatient admissions, and it makes no assumption that variables included in the model directly alter the clinical judgment of physicians and other clinical providers. However, it is important to evaluate these compounding influences, as most studies of predictive models are micro-focused, focusing on single hospitals or a

narrow clinical condition. This level of detail is required to fully uncover where organizational variables offer greater descriptive power (Williams et al., 2016).

The unconventional approach to evaluating layers of influence yields the most robust conclusions when comparing the relative impact on model-prediction confidence. The results suggest that while age and clinical condition are highly relevant, many broader influences overshadow the historically included model variables of race, ethnicity, and even sex. For example, proportions as built from values in ***Table 1.3*** show that hospital ownership has a variable impact ratio of more than 19 compared with race. The ratio of impact from occupancy rates over sex is nearly double. Finally, the relative model predictive impact of insurance is almost 60 times that of ethnicity.

Once these layers of influence are recognized for their significant and relevant impact, we can expand on their implications by examining intra-layer and intra-variable variances. As the second layer contains hospital characteristics, hospital ownership bears further review. ***Figure 1.4*** illustrates the 95 percent confidence intervals for predictive variability in admission between government-controlled, nonprofit organizations, and hospitals owned by for-profit entities. The emphasis on profitability is visually divergent, suggesting that organizational expectations influence clinical decision-making. Research indicates that implicit factors, such as organizational pressure and workload, significantly impact physician judgment *(Hajjaj et al., 2010)*, and aggressive use of payment models links to ED-based admissions and lengths of stay *(Chaix-Couturier et al., 2000)*. Alternatively, viewed through the lens of institutional financial incentives, directed investments in specific resources

facilitate higher inpatient throughput. In accordance with the principle of profit maximization, hospitals are motivated to allocate resources to high-margin admissions, since inpatient costs are fixed in the short term.

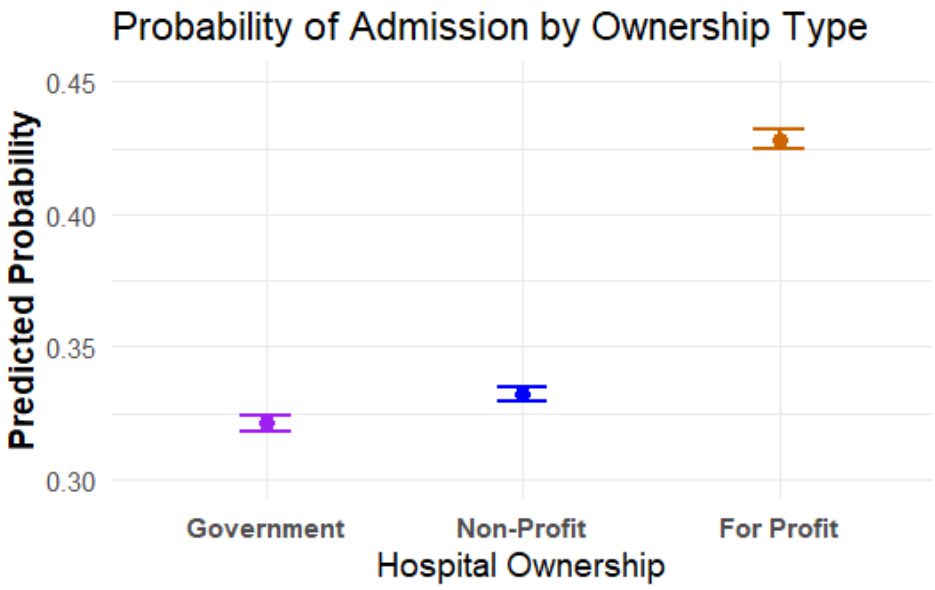


Figure 1.4: Probability of Admission by Ownership Type

Age and comorbidity have the greatest impact on changes in BIC, followed by the external variable of insurance. The relative impact of insurance payer on the probability of admission is demonstrated in ***Figure 1.5***. Although Medicare and Medicaid patients have the highest admission probabilities, these associations may be influenced by confounding social determinants. For instance, Medicaid enrollment requires that an individual's financial resources remain below specific thresholds. Limited income is frequently linked to housing insecurity, which has been associated with an increased likelihood of admission (Kushel et al., 2006). Medicare beneficiaries may face similar challenges, such as a lack of safe living spaces or the absence of informal caregivers. When safe discharge options are unavailable, hospitals effectively

serve as a social safety net of last resort; consequently, this dynamic increases the likelihood of admission for these vulnerable populations.

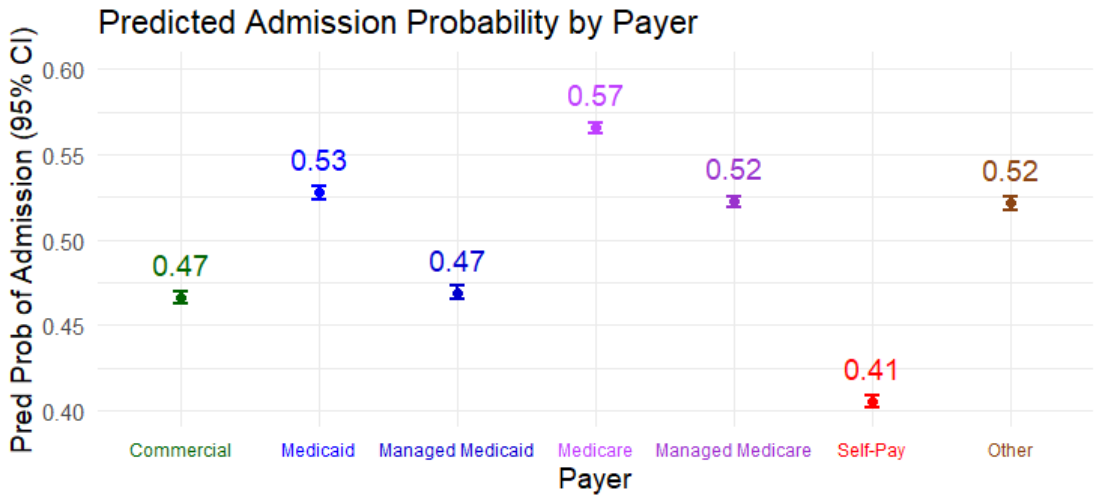


Figure 1.5: Predicted Admission by Payer

Intra-insurance variation is presented in ***Figure 1.6*** where it illustrates the comparative likelihood of admission for traditional Medicare and Medicaid payers versus their private managed care counterparts. In both instances, the likelihood of admission is reduced by 5 and 6%, respectively. While these programs ideally connect patients to cost-effective resources to maintain health, it is significant that this reduction persists even among patients who have already presented to an Emergency Department for advanced care.

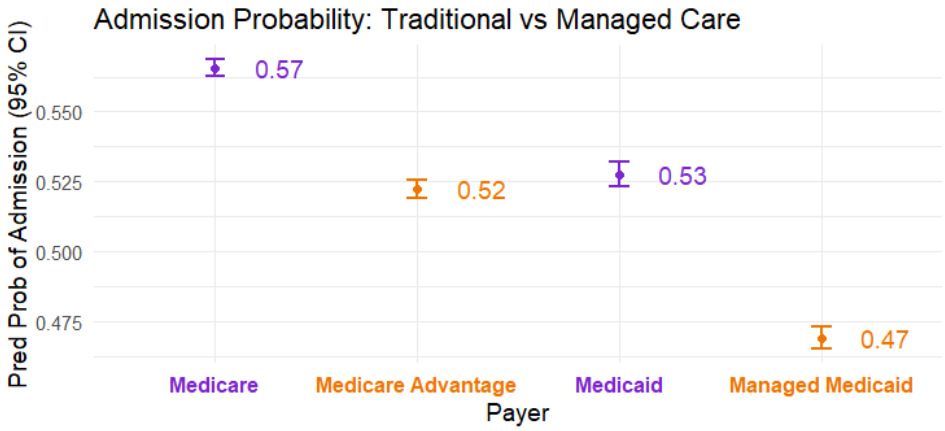


Figure 1.6: Prediction Admission Comparison of Managed Care

Managed care protocols, such as prior authorization requirements, can create barriers at the point of admission. Hospital staff, who are integrated into the organizational influence, may proactively or unintentionally avoid admitting patients to these plans when they anticipate significant placement challenges. Because securing authorization for skilled nursing facilities or rehabilitation centers can be a daunting challenge, the risk of a prolonged, uncompensated length of stay deters initial inpatient admission. Furthermore, population bias may also influence these outcomes. Managed care plans may enroll participants with unmeasured variables of influence on the model. Inherently healthier individuals should be accounted for with the comorbidity variable. However, these populations may have fewer social complexities that would otherwise be associated with hospital admission.

Occupancy, a highly impactful variable that nonintuitively increases admission probability, suggests a complex interplay between organizational capacity and clinical decision-making. As inpatient and ED volumes converge, reduced capacity often impairs the staff's ability to perform extensive patient workups. This creates operational inefficiencies consistent with Cognitive Load Theory *(Vella et al., 2021)*.

Under extreme cognitive stress, clinicians may prioritize admission over discharge because discharging a complex patient requires significant time for logistical coordination and safety documentation. In contrast, admission serves as a faster, more administratively efficient, and legally conservative mechanism for managing overwhelming workloads. Consequently, admission may be used to clear mental queues during periods of high demand, whereas lower occupancy levels provide the resources necessary to deliver comprehensive treatment plans that prevent hospitalization. Additionally, there is the organizational incentive to encourage admission. As revenue increases with every admitted patient, the current reimbursement system effectively rewards hospitals for failing to manage capacity, allowing them to profit from incremental occupancy despite rising operational inefficiencies.

Despite controlling for distorting influences, variable interactions and multicollinearity are presumed to be present to varying degrees. The ownership and occupancy variables were included in a secondary analysis to examine their moderating effects. Including the interaction yielded an improved statistical fit, as evidenced by the lowest observed BIC of 4,673,218. This interaction is visually demonstrated in ***Figure 1.7***. While for-profit hospitals maintain a lower overall admission threshold, the likelihood of admission positively correlates with occupancy up to 95.4%. The interplay between variables is apparent with divergent thresholds, plotted curvature, and peak points. The previously discussed financial influences of for-profit ownership, which push the limits of capacity, combine to have a magnifying effect.

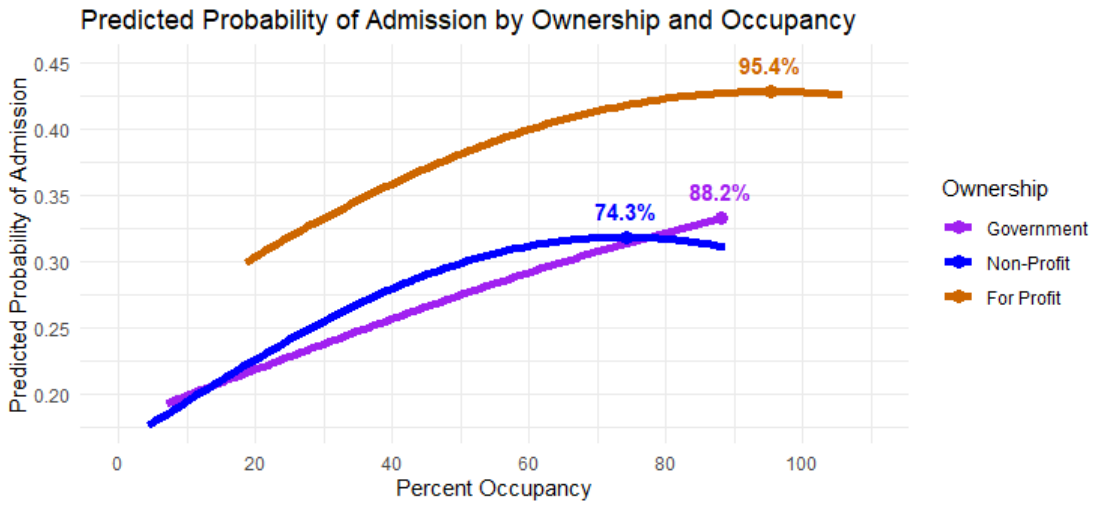


Figure 1.7: Moderating Evaluation of Ownership and Occupancy

1.9 POLICY IMPLICATIONS

The findings of this study suggest that current reimbursement structures and institutional characteristics exert a disproportionately underappreciated influence on the decision to admit patients from the Emergency Department. Without adjustments to financial incentives, hospitals will continue to emphasize admissions because they face substantial fixed costs, and increasing patient volume yields a high marginal return on investment.

At the state level, authorities should revisit subsidy programs designed to address Medicaid shortfalls and review facility-level admission patterns to determine whether they align with established benchmarks and subsidy objectives. If a hospital demonstrates an over-admitting pattern inconsistent with clinical necessity, state payments should be reallocated to more efficient providers, including competing hospitals and external ambulatory agencies. By modifying payment structures to

emphasize value over volume, over-admission can be transformed from a financial liability into a revenue generator.

The correlation between hospital size and the probability of patient admission suggests that institutional scale exerts a significant, practical influence on clinical outcomes. This relationship aligns with Roemer's Law and the principle of supply-induced demand, which posits that the mere existence of healthcare resources can lower the threshold for their utilization *(Shain & Roemer, 1959)*. Consequently, while resource-constrained smaller hospitals must exercise greater selectivity, larger institutions often exhibit a lower admission threshold, resulting in higher healthcare costs for diagnostic workups that are manageable in outpatient settings. To mitigate these rising costs, state regulators should reevaluate Certificate of Need (CON) programs to restrict the expansion of bed supply if additional capacity serves primarily as a driver of utilization rather than a mechanism for improving population health.

A sustainable strategy involves shifting institutional focus away from bed expansion and toward the optimization of less costly services through telemedicine and remote technologies. Through these tools, smaller hospitals with underutilized capacity can manage patients locally with clinical confidence, while remote consultations in assisted living facilities could prevent hospitalizations driven solely by the need for specialist access. Furthermore, the persistent link between Medicare or Medicaid status and higher admission rates suggests that non-clinical determinants are preventing effective outpatient care. Enhancing resources for home health and specialized subacute care can prevent the safety-net admissions currently observed among vulnerable populations. Ultimately, policy changes may be necessary to ensure

improved payments for outpatient services and to support the capacity to care for patients outside the expensive hospital environment.

1.10 LIMITATIONS

This study relies on a cross-sectional analysis of a single calendar year, which precludes evaluating longitudinal trends or multi-year policy shifts. Consequently, the findings represent statistical associations among social, financial, and clinical factors rather than direct linear causality. Generalizability is further constrained by Florida's specific demographic profile, which has a higher median age and organizational characteristics that vary from other regions of the country.

Data limitations regarding clinical granularity and provider specificity also merit consideration. The model utilized administrative datasets that lacked real-time physiological markers such as vital signs, though available encounter data was used to approximate acuity. Additionally, the available data did not account for individual physician-level variance; however, prior literature suggests that specific provider attributes account for a minimal fraction of admission rate variation compared to organizational factors *(Smulowitz et al., 2021)*.

Administrative classifications regarding patient status and financial metrics present inherent challenges. The datasets did not clearly distinguish observation status from general Emergency Department encounters, which obscures a subset of patients who occupy hospital beds without a formal inpatient designation. This ambiguity is compounded by retrospective insurance denials that may reclassify inpatient admissions to outpatient status despite identical clinical management.

1.11 Future Work

A major consideration going forward in any healthcare research is that analyses must account for or control for the broader influence of organizational characteristics that are generally absent from the literature and from robustness checks. While this study focused on a population with clinical uncertainty, the findings are consistent or even more pronounced when the population is expanded (***Appendix D***). Future investigations should expand the scope of organizational and financial variables to include specific institutional health indicators such as operational margins or days of cash on hand. While these metrics provide deeper insight into organizational stability, researchers must account for significant inconsistencies in financial reporting standards across ownership types. Given the rapid consolidation within the healthcare landscape, this study should be replicated using longitudinal data to capture the effects of recent market shifts. Specifically, many for-profit hospitals in Florida have been acquired by nonprofit entities, creating a natural experiment to determine whether clinical admission behaviors persist under new ownership structures or evolve to align with the acquiring system.

Research should also examine how organizational evolution driven by survival pressure influences mission adherence. As entities adapt to external environments that reward profitability over original purpose, future studies could measure the extent to which charitable missions are displaced by financial imperatives. Furthermore, because inpatient services account for approximately 38% of condition-specific expenses, reducing the conversion rate from Emergency Department visits to admissions yields a higher financial impact than merely reducing ED volume

(Smulowitz et al., 2013). Consequently, subsequent research should focus on identifying the specific organizational constraints, such as bed supply and revenue targets, that predetermine clinical options before a patient arrives.

2 BEYOND OUTCOMES: INCORPORATING ORGANIZATIONAL COMPLEXITY INTO VALUE-BASED PURCHASING DESIGN

2.1 INTRODUCTION

Value-based purchasing (VBP) programs, pioneered by the Centers for Medicare and Medicaid Services (CMS), aim to align financial incentives with high-quality, efficient care. With approximately $1.7 billion in Medicare funding reallocations at stake and the commercial market shifting 45% of its $1.4 trillion in annual payments towards models that include quality outcomes, the financial pressure on hospitals to adapt is undeniable (Centers for Medicare & Medicaid Services, 2024, 2025a, 2025b; Centers for Medicare & Medicaid Services (CMS), HHS, 2011; Health Care Payment Learning & Action Network, 2025; Rosenbaum, 2011).

Despite the conceptual appeal of "paying for performance," empirical evidence regarding VBP effectiveness remains mixed with significant variability across health systems (Cattel & Eijkenaar, 2019; Congressional Budget Office, 2023; Figueroa et al., 2016; Hong et al., 2020; Mathes et al., 2019; Ryan et al., 2017; Sautter et al., 2007; Sorbero et al., 2014; Vlaanderen et al., 2019). Historically, these inconsistent outcomes have been interpreted as evidence of program ineffectiveness. However, this essay argues that "mixed results" are not a sign of policy failure, but rather an indication that financial incentives operate within a complex system where outcomes are contingent upon institutional context.

To understand this variability, we can use a clinical analogy: a medical treatment’s success depends on complex interactions between the delivery, patient

"biological factors," and “environmental” factors (W. S. Jones et al., 2021). Consider the organization as the patient and VBP as the treatment. In healthcare management, organizational characteristics (e.g., governance, culture, leadership, and resources) act as the "biological factors" that determine how a financial incentive is translated into clinical quality. Failing to account for these interactions renders policy conclusions and managerial implications fundamentally incomplete.

Existing research focuses heavily on patient outcomes but often overlooks how organizational structures mediate those effects. This gap limits the understanding of why identical incentive environments yield inconsistent results. This inquiry addresses the deficits in current VBP design, introducing an Organizational Mediation Hypothesis to a narrative review of existing literature, specifically seeking to identify the structural characteristics that mediate the relationship between financial penalties and clinical quality improvements.

2.2 Framework: Linking Organizational Context

Efforts to reform hospital payment methods in the United States have evolved from purely fee-for-service reimbursement toward models that reward outcomes. Value-based purchasing represents a policy instrument grounded in the principle that financial incentives can drive organizational change. The theoretical foundations of VBP align with several well-established perspectives in organizational and economic theory, including agency theory, bounded rationality, and Donabedian’s structure–process–outcome model. Together, these frameworks clarify how organizational

characteristics mediate the translation of payment incentives into actual improvements in quality and performance.

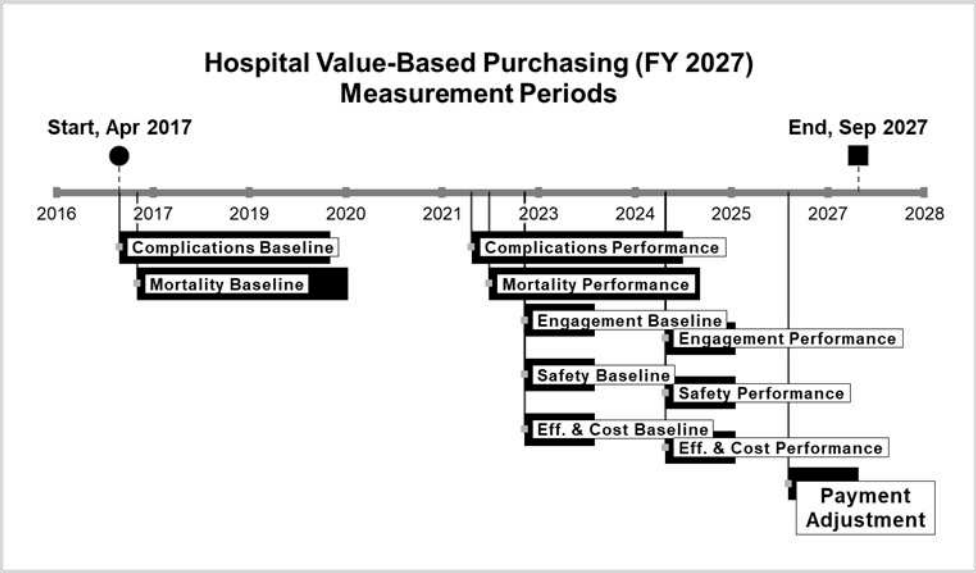
2.2.1 Agency Theory and Complexity

Agency theory offers a valuable perspective on understanding how payment incentives align the interests of multiple stakeholders in healthcare delivery. Within a VBP framework, the U.S. government functions as the *principal* that delegates responsibility to *agents* such as hospitals. These agents are expected to produce defined quality outcomes for the population they serve. The logic assumes a relatively direct relationship between the principal and the agent, in which financial rewards or penalties encourage behavior consistent with shared goals (Eisenhardt, 1989).

In practice, the hospital environment complicates this assumption. The agent in healthcare is rarely a single entity. It is instead a nested network of organizations, departments, and professionals that operate with partially aligned objectives. Within this multilayered structure, information asymmetry and the costs of monitoring or delegation can weaken the connection between incentive design and frontline behavior. When the principal lacks insight into the agent's internal operations, policy intent may diverge from implementation reality. For example, the Chief Financial Officer is attuned to the budget line-item variances in overtime pay. Yet, they lack the perspective of the front-line nurse who cannot walk away from patient care needs that extend beyond their scheduled shift. The effectiveness of VBP, therefore, depends not only on the magnitude or structure of the incentives but also on the organization’s capacity to translate those incentives into coordinated operational actions (Heath & Sitkin, 2001; Jensen & Meckling, 1976).

2.2.2 Bounded Rationality: Limitations

The inherent limitations of human cognition and organizational decision-making compound the complexity of hospital systems. This phenomenon, described by Simon as bounded rationality, recognizes that individuals and organizations make decisions under constraints of limited information, time, and attention (Cowan, 2001; Simon, 1955). The multilayered and temporal nature of performance measurement intensifies these limitations. Decisions at the clinical level occur through hundreds of interactions each day and are shaped by hierarchical layers of management and oversight (McKenzie et al., 2015). The link between a clinician's decisions and a hospital's eventual payment adjustment, realized over 10 years, is indirect and diluted, as illustrated in ***Figure 2.1***.



(Fiscal Year (FY) 2027 Hospital Value-Based Purchasing (VBP) Program Quick Reference Guide, 2024)

Figure 2.1: Hospital Value-Based Purchasing Timeline

> *The 10-year lag between measurement and payment creates a cognitive disconnect for frontline clinicians making daily decisions.*

The inherent limitations of human cognition under constraints of time and attention are defining elements of Bounded Rationality that explain why small incentives (<2%) fail to pierce through the noise of daily hospital operations (Fiscal Year (FY) 2027 Hospital Value-Based Purchasing (VBP) Program Quick Reference Guide, 2024; Sautter et al., 2007). The causal pathways between incentive and outcome stretch beyond the hundreds of real time choices of clinicians as they care for their patients in high pressure environments. To be effective while maintaining the assumptions of Agency, policy incentives must either be larger or targeted at specific decision-making units.

2.2.3 Structure Matters

Donabedian's structure–process–outcome model remains foundational in understanding the organizational determinants of quality. Donabedian defined structure as "the settings in which care takes place," encompassing material assets, human resources, and administrative organization (Donabedian, 1966, 1988). VBP programs often focus on inputs and outcomes while overlooking the structural conditions that enable these outcomes.

In healthcare organizations, structure is expressed through characteristics such as size, ownership, governance, staffing patterns, and information infrastructure. These features shape the processes by which care is delivered and influence the outcomes. Well-resourced hospitals with integrated data systems and clear lines of accountability are often better positioned to respond to performance incentives. In contrast, smaller or less cohesive organizations may struggle to translate those incentives into measurable improvements in care. Just as patient improvement cannot be evaluated without understanding the context of the individual, performance under value-based purchasing cannot be evaluated without considering the organizational conditions in which it occurs.

The Systems Engineering Initiative for Patient Safety (SEIPS) model extends Donabedian's framework by acknowledging healthcare as a system in which structure, processes, and outcomes are interdependent and continuously influenced by their environment (Carayon et al., 2006). SEIPS emphasizes that no single variable operates independently; rather, contextual factors such as workflow design, technology integration, communication patterns, and human factors interact to shape quality

outcomes. Continuing with the diagnostic imaging example, injecting an intervention, such as contrast dye, should not occur without understanding the broader body, including the state of the kidneys. Within the context of value-based purchasing, this perspective underscores that performance results from iterative feedback between organizational systems and the care processes they support.

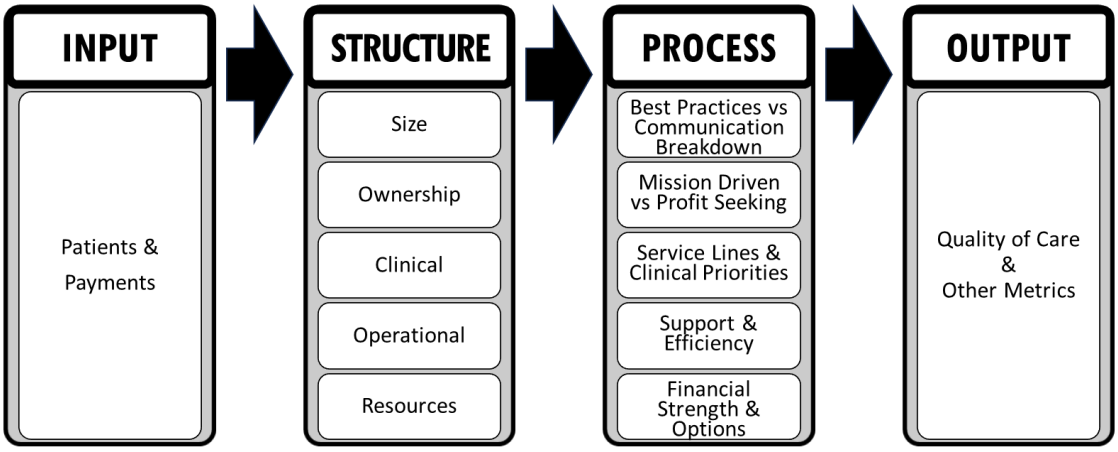


Figure 2.2: Input, Output, and Donabedian's Structure-Process-Outcome

2.2.4 Integrating Perspectives

Taken together, these theoretical perspectives emphasize that the success of value-based purchasing depends on the organizational systems that interpret and act upon financial incentives. Agency theory highlights the challenges of delegation and alignment within complex institutions. Bounded rationality explains the cognitive and informational limits that constrain decision-making. Donabedian's framework positions both within a tangible context of structure connecting to outcomes. ***Figure 2.2*** presents a visual where inputs interact with Organizational Mediators before generating an output that is filtered or enhanced along the way. Incorporating these theoretical insights into empirical research can move the field beyond descriptive

correlation toward an explanatory understanding of why performance varies across hospitals participating in VBP programs.

Building on these integrated perspectives, this paper argues that the focus of inquiry should shift from evaluating whether VBP is effective to understanding the mechanisms through which it is mediated. The study proposes the Organizational Mediation Hypothesis, which identifies institutional architecture as an indispensable driver of performance variance. In this model, the mediation of policy outcomes is determined by the degree of cognitive strain at each organizational layer and the structural distortions that occur when the pursuit of financial resources conflicts with the original mission of the institution.

2.3 METHODS

This narrative literature review was guided by the PRISMA 2020 framework and the methodological guidance from the Joanna Briggs Institute (JBI) for evidence synthesis but did not involve a team of independent coders (Page et al., 2021; Von Elm et al., 2008). A systematic search of the MEDLINE database via PubMed was conducted between September 2023 and October 2025. An iteratively developed search strategy incorporated MeSH terms and relevant keywords associated with value-based purchasing, hospitals, quality outcomes, and organizational characteristics. Query terms are provided in ***Appendix 0.1***.

Studies were eligible if they examined hospital-level organizational characteristics within the context of value-based payment performance and reported clinical quality outcomes. Articles focusing solely on patient satisfaction, operational

efficiency, or aggregated scores without identified clinical outcome measures were excluded. The inclusion criteria required peer-reviewed, English-language publications that involved U.S. hospital settings.

The initial search yielded approximately 30,000 records. After title and abstract screening and full-text review, 26 studies met the inclusion criteria. Identification, screening, and inclusion details such as reasons for exclusion are listed in ***Appendix 0.2: PRISMA flow diagram***. After abstracts were screened for value-based financial payments, the lack of consideration for organizational characteristics removed 31% of the remaining articles. Data were extracted using standardized templates to ensure consistency and reproducibility. Extracted information included study design, data sources, value-based payment models, outcome measures, and statistically significant organizational characteristics ($p \leq 0.05$).

Due to heterogeneity in study design and outcome measures, findings were synthesized narratively, and organizational characteristics were grouped into thematic domains. Descriptive identifiers such as payer mix or community context were noted but treated as environmental inputs rather than intrinsic organizational traits (***Appendix 0.3***). Aggregated findings by article are summarized in ***Appendix 0.4: Literature Reviewed Details for Analysis.***

2.4 FINDINGS

The current body of literature examining the intersection of value-based payment programs, hospital organizational characteristics, and patient outcomes remains limited in both scope and methodological consistency. Across the reviewed

studies (n = 26), results were highly variable, and only five articles demonstrated consistent associations between organizational attributes and value-based purchasing performance. In most analyses, organizational characteristics were often restricted to structural variables (e.g., size, teaching status, ownership) rather than encompassing organizational culture, leadership, or workforce composition (Carroll & Clement, 2021; Muhlestein et al., 2016). Furthermore, while a few studies identified performance variation attributable to system affiliation or hospital efficiency, others reported no statistically significant relationships between participation in federal incentive programs and quality outcomes (Borah et al., 2012; Hsu et al., 2020; Spaulding et al., 2014). In many cases, the lack of consistent findings may reflect both methodological heterogeneity and the absence of comprehensive models.

Importantly, none of the studies explicitly examined moderating or interaction effects between organizational characteristics. For instance, several papers noted that hospitals with Magnet status may perform better on certain VBP domains; however, there was limited evidence of a connection to the resources required to attain such status (Boylan et al., 2019; Dierkes et al., 2021; H. Y. Hamadi et al., 2021; Menser et al., 2023; Spaulding et al., 2020).

While deductions regarding causal pathways between organizational characteristics and value-based performance are premature, limited thematic patterns were identified and grouped into five categories: Size, Ownership Structure, Clinical Structure, Operational Structure, and Resources.

Table 2.1 summarizes the identified categories and includes article representation percentages by grouped characteristics. *Positive* associations were

noted when a characteristic improved one or more outcomes. *Negative* associations were identified where there were consistently detracting results. If a variable was linked to positive outcomes in one instance and a negative outcome in another, the characteristic was categorized as *Mixed*. Outcomes evaluated by each article are included in the column "Quality Outcomes Measured" within ***Appendix 0.4***: Literature Reviewed Details for Analysis.

Table 2.1: Identified Organizational Characteristics

Category	Size		Ownership Structure				Clinical Structure			Operational Structure				Resources	
Subgroup	*Size = Large*	*Size = Small*	*Ownership For-Profit*	*Ownership Non-Profit*	*Ownership Government*	*System Integrated*	*Teaching Hospital*	*Nursing Magnet®*	*Clinical Specialization*	*Infrastructure Support*	*ACO participation*	*Cultural Support*	*Efficiency*	*Income*	*Staffing Levels*
Positive (p)	4	2	3	5	3	4	6	3	1	3	2	1	4	1	1
Negative (n)	4	2	5	0	7	0	2	0	0	0	0	0	0	0	0
Mixed (m)	4	1	1	0	0	0	2	3	0	1	1	0	1	0	0
Represented	46%		50%				62%			42%				8%	

(Banerjee et al., 2019; Beauvais et al., 2024; Bhattacharyya et al., 2008; Carroll & Clement, 2021; Chatterjee & Joynt Maddox, 2018; Dierkes et al., 2021; H. Hamadi et al., 2018; Hsu et al., 2020; C. W. Jones et al., 2014; Koenig et al., 2017; Menser et al., 2023; Noghrehchi et al., 2024; Sautter et al., 2007; Spaulding et al., 2014, 2018, 2020; Vina et al., 2009; Zhao et al., 2015)

2.5 DISCUSSION

Many key institutional attributes remain underappreciated. In the reviewed studies, ownership was typically relegated to an oversimplified obligatory control variable. It was usually categorized as government, nonprofit, or for-profit, with no granularity beyond these groupings. While legal ownership is a fixed attribute, the underlying motivations and managerial assumptions associated with each type create

essential distinctions. For-profit organizations are presumably driven by shareholder value, emphasizing financial performance and the use of real-time data dashboards for operational monitoring. Metrics such as length of stay, referral-source admissions, and staffing ratios serve as early indicators of financial performance. With encouragement, updated dashboards can identify clinical adherence to best practices or the need to intervene promptly based on variations in health. In contrast, nonprofit hospitals are presumed to prioritize mission-based goals that align with community service and patient well-being. Monetary incentives may play a diminished role in motivating improvement because quality initiatives are already integrated into organizational culture. In these cases, external incentives can even be counterproductive if they disrupt established priorities.

2.5.1 Size

Organizational size was a frequently cited characteristic, although all studies measured it only by bed count. Size encompasses far more than just the number of employees, patient volume, geographic spread, and network affiliations. Larger organizations may benefit from economies of scale and greater access to specialized expertise, reducing the marginal effect of additional financial incentives (Spaulding et al., 2018; Zhao et al., 2015). However, extensive size can also dilute individual influence and reduce responsiveness. As the number of decisions and interactions expands, the contribution of any single clinician becomes statistically insignificant, potentially weakening the connection between performance incentives and outcomes.

The consolidation trend in the U.S. hospital market magnifies these dynamics. Between 1985 and 2022, the annual increase in hospital payments was 4.9% (Centers

for Medicare & Medicaid Services, 2025b). However, in 2024 the 20 largest hospital systems by patient revenue expanded at an average rate of 8.2%, and the top 10 fastest growing systems ranged patient revenue increases between 17% and 49% (Madden, 2025). Rapid mergers and acquisitions impose substantial cognitive and operational strain. The integration of information systems, workflows, and organizational cultures can take years, often outlasting incentive cycles. Understanding how value-based purchasing interacts with such large-scale change is an important area for future research.

2.5.2 Ownership Structure

A concept largely absent from the empirical literature is **psychological ownership**, which extends beyond legal control to include feelings of belonging, autonomy, and self-investment (Avey et al., 2009; Pierce et al., 2001; Van Dyne & Pierce, 2004). A doctor can never actually own a patient, but they can be invested in their wellbeing. This construct of psychological ownership helps explain how internal motivations influence engagement with quality initiatives, which may vary between the scope of a single patient or the broad reach of a regional health system. Care givers who perceive a strong sense of ownership are more likely to align their personal efforts with organizational aims. Examining changes in such perceptions before and after policy interventions could clarify whether financial incentives reinforce or conflict with intrinsic motivations for quality (Handy & Katz, 1998).

Leadership style is another extension of ownership at the organizational level. In highly centralized systems, decision-making authority is concentrated at the top, which can limit the flexibility of local managers and clinicians in responding to

situational needs. Conversely, highly participatory leadership structures can generate competing priorities and diffuse accountability. Overly democratic approaches may lead to disproportionate resource allocation based on emotion rather than value, while rigid hierarchies risk missing context-specific decisions that support patient care. Balancing centralized oversight with localized discretion appears essential for maintaining alignment between organizational priorities and value-based goals.

As health systems expand, hierarchy becomes necessary to manage complexity, but it also introduces layers that may obscure accountability. Hierarchical structures arise partly in response to bounded rationality: the recognition that no single leader can process all relevant information. Yet how these layers are configured can influence performance quality. Departments such as information technology or finance may dominate strategic discussions, diverting attention from patient outcomes. Conversely, flatter structures may amplify clinical perspectives in decision-making. The extent to which executive leaders maintain proximity to patient care can also shape institutional priorities. A chief executive who regularly interacts with patients may interpret value-based metrics differently from one focused on interstate system-level expansion. Changes in hierarchical design can further affect performance management and the locus of professional authority. The transition from peer-based physician accountability to direct employment models has, in some contexts, weakened professional self-regulation and been associated with adverse quality implications (Flood, 1994).

2.5.3 Clinical and Operational Structure

Teaching hospital status emerged inconsistently as a correlate of value-based performance. Although often treated as a control variable, academic hospitals possess characteristics that logically support quality improvement: concentrated intellectual capital, academic research infrastructure, and continuous physician presence. The availability of specialized staff and resources enhances their capacity to meet performance benchmarks (Gajic et al., 2008). Government policy recognizes the cost intensity of these institutions and provides supplemental payments to offset higher resource utilization (Chen et al., 2020; Wynn et al., 2013). While such funding complicates direct comparison, it underscores that institutional resources remain central to outcome performance.

Community engagement provides another window into an organization's orientation. Some institutions focus community investment efforts on generating demand through marketing, reinforcing a volume-based logic. Others allocate resources to public health initiatives, such as free vaccination clinics or wellness programs, which reduce hospital utilization. These latter activities align more closely with the goals of value-based care, which seeks to improve outcomes while reducing unnecessary spending. Although nonprofit hospitals are required to report community benefit expenditures, accounting standards vary, limiting comparability (Department of the Treasury Internal Revenue Service, 2024). For-profit organizations also contribute to community initiatives, often blending social investment with brand development and consumer loyalty strategies.

2.5.4 Resources

Resource availability is a core element of any organization's success, yet it is largely an overlooked factor related to the evaluation of VBP success. Hospitals with limited capital reserves struggle to invest in the infrastructure needed for real-time monitoring or evidence-based interventions. For example, the costs associated with Magnet® certification, estimated at approximately $500,000 annually, place it beyond the reach of many institutions (Department of the Treasury Internal Revenue Service, 2024). Similarly, technologies such as robotic surgery or advanced electronic health record systems require significant upfront investments. As a result, quality improvement under value-based models may rely less on motivation and more on access to the necessary tools and expertise for implementation. This quality paywall drives a perpetuating wedge of inequality between the haves and have-nots.

The **magnitude of revenue** also shapes the relevance of value-based incentives. For large systems with diversified revenue streams, the proportion of income affected by VBP adjustments may be too small to alter strategic behavior. Alternatively, a hospital's smaller revenue and size may allow the payer organization to dictate contract terms, thereby increasing motivation. In either case, financial structure interacts with organizational capacity to determine responsiveness to incentives.

Across the dimensions of size, ownership, structure, and resources, the literature reveals patterns but few certainties. The heterogeneity of findings reflects both methodological variation and the complexity of the phenomena studied. Organizational characteristics clearly shape the capacity to respond to value-based incentives; however, the mechanisms underlying this response remain only partially

understood. Further research is needed to isolate the structural and cultural attributes that most effectively translate financial incentives into improved outcomes.

2.5.5 Limitations

This review has resource-based limitations, as it was conducted by a single investigator, which introduces the potential for selection and interpretive bias. The investigator's extensive professional experience in healthcare administration (over 30 years, including 20 years in leadership roles) provided valuable contextual understanding of organizational operations and policy environments. However, this expertise may also have influenced how studies were interpreted and synthesized. To reduce potential bias, all methodological decisions followed PRISMA 2020 procedures and were documented in an audit trail. Additionally, the heterogeneity of included studies limited the ability to perform quantitative synthesis or draw definitive conclusions. Despite these limitations, this review offers an essential overview of what is known and what remains unknown about the organizational influences on hospital performance under value-based purchasing.

2.6 CONCLUSION

Variation in hospital performance under value-based payment programs reflects not only financial and structural characteristics but also the interdependent nature of clinical work within organizations. Patient outcomes arise from a continuum of coordinated actions rather than the choices of any single clinician. For example, nurses' ability to identify early signs of patient deterioration and communicate them effectively depends on conditions such as staffing adequacy, communication processes, and a culture that empowers frontline caregivers. These relational and procedural dynamics demonstrate that organizational design mediates clinical

outcomes. Success in value-based purchasing requires an alignment between financial motivation and clinical practice to promote shared accountability. In this context, organizational culture acts as a critical determinant that guides institutional responses. In hospitals where qualitative care is prioritized (Kroeber & Kluckhohn, 1952), a culture of improvement provides essential direction when explicit performance metrics are insufficient to capture the nuances of clinical quality. Sustaining progress in VBP, therefore, depends as much on fostering a collective commitment to excellence as on measuring discrete performance indicators.

A notable limitation of the existing literature is the absence of analysis examining interactions among organizational characteristics. Ownership, for example, may explain part of the variance in performance; however, its influence cannot be fully understood without considering factors such as size, structure, and resource allocation. The assumption that nonprofit hospitals inherently prioritize mission over margin oversimplifies the interplay between values and constraints. A clinician who is prevented from using essential equipment because of the finance department's goals illustrates how internal conflicts can inadvertently undermine broader goals.

Because current models fail to capture these structural interactions, future policy updates must expand to include the interplay between institutional inputs and organizational traits. While CMS risk-adjustment models currently account for patient clinical complexity, they continue to overlook the critical factor of organizational complexity. CMS should pilot an "Organizational Complexity Index" to adjust VBP penalties, similar to how it uses Social Risk Factors (SRF). Stratifying peer groups by hospital structural characteristics (e.g., teaching status, safety-net status) would

prevent unfairly penalizing institutions with characteristics that dampen the effect of financial incentives. Redirection of funding without this organizational context undermines equity efforts by diverting resources from hospitals that serve the most vulnerable of patients.

Policy improvements in value-based purchasing will require a more integrative approach that links clinical behaviors with organizational environments. A bottom-up analytic framework, beginning with the experiences of patients and frontline staff, can illuminate how each organizational layer perceives its inputs and outputs. When staff at all levels view quality outcomes as both meaningful and supported by the institution's structure, culture, and resources, incentives are more likely to achieve their intended effects. Identifying these connections offers a path to refine both organizational design and payment policy to improve hospital quality and equity. Individualizing incentive payments to specific frontline parties is logistically impossible; however, the intent could be achieved by legislating transparency into how rewards are distributed and what allocations support staff, infrastructure enhancements, or executive compensation.

This evaluation prompts multiple avenues for future research to explore. Mechanism Isolation: What specific structural and cultural attributes most effectively translate financial incentives into improved outcomes? Index Validation: Does the implementation of an Organizational Complexity Index effectively reduce inequitable redistribution of payments to safety-net institutions? Change Dynamics: How do rapid mergers and acquisitions affect the cognitive disconnect experienced by providers and caregivers during long VBP cycles? Transparency Effects: To what extent does

transparency regarding reward distribution improve internal alignment and psychological ownership?

Ultimately, evidence so far remains inconclusive, not because the link between organizational characteristics and performance does not exist, but because the concepts have yet to be systematically explored. Illuminating the structural reasons behind incentive success and failure is essential to establishing a context-aware understanding of VBP reforms. By incorporating the Organizational Mediation Hypothesis into future designs, policymakers can ensure that financial incentives promote genuine quality improvement rather than merely reinforcing existing institutional inequities.

3 THE EVOLUTION OF QUALITY: A CASE STUDY ON CARE DELIVERY INNOVATION AND THE ALIGNMENT OF VALUE-BASED PURCHASING

3.1 INTRODUCTION

In response to escalating costs and persistent concerns about healthcare quality, Value-Based Purchasing (VBP) has expanded significantly, growing from 25% of total U.S. healthcare spending in 2014 to nearly 50% by 2024 (AHIP, 2026). Theoretical frameworks driving VBP models are primarily grounded in Agency theory, which suggests that individuals adjust their behaviors in response to financial incentives (Conrad, 2015; Emanuel et al., 2016; Frølich et al., 2007; Li, 2022). Accordingly, VBP seeks to align provider compensation with organizational performance on clinical quality indicators, thereby incentivizing improvements in patient outcomes and promoting more efficient care delivery (Berwick et al., 2008; Chee et al., 2016; Eijkenaar & Schut, 2015; Mendelson et al., 2017; Petersen et al., 2006; Porter & Lee, 2013).

Empirical studies indicate that clinicians' behavioral responses to financial incentives are often modest and inconsistent (S. Jain et al., 2019; Leao et al., 2023; Petersen et al., 2013; Sorbero et al., 2014). Numerous studies examining VBP models have reported only modest or mixed improvements in process measures, while demonstrating minimal impact on long-term patient outcomes (Banerjee et al., 2019; Hsu et al., 2020; Sorbero et al., 2014). Factors such as small incentive sizes, measurement overload, and the potential for incentives to crowd out intrinsic motivation can dilute the impact of these models (Leao et al., 2023; Sorbero et al.,

2014). Furthermore, complex or poorly aligned incentives may lead to confusion or resistance among providers (P. Jain et al., 2025; S. Jain et al., 2019; Khalil et al., 2025; Leao et al., 2023).

This paper suggests that the most effective way for VBPs to influence behavior and improve quality is not through direct clinician incentives but by shaping the organizational environment to support better care delivery and accountability. By shifting the focus to the organizational level, this research utilizes a qualitative case analysis of the BAYADA Home Intensive Care Unit (HICU®) program to investigate how quality-linked payments motivate the infrastructure investment and process redesign required to improve outcomes for medically complex pediatric patients.

3.2 Case Study: Bayada's HICU® Program

As a provider of health services, BAYADA Home Health Care offers a valuable opportunity for a case study in value-based clinical care. Founded in 1975, BAYADA delivers a comprehensive range of specialized services, including personal care, short-term nursing, and pediatric private duty nursing, and operates in 22 states and five countries. In 2019, the organization converted to a non-profit entity while adhering to a core philosophy centered on compassion, excellence, and reliability (BAYADA Home Health Care, 2024). Within this framework, BAYADA developed the Home Intensive Care Unit (HICU®) program, a specialized care program for infants and children transitioning from neonatal or pediatric intensive care units to a home setting. While conceptual development for the program initiated several years prior, a formal pilot program was launched in 2022 (HICU 201, 211). The program is

currently active or being explored in several markets, including Pennsylvania, New Jersey, Delaware, Massachusetts, Washington, D.C., Maryland, and New York (HICU 213, 219).

The HICU® program addresses the needs of patients who would otherwise be ineligible for hospital discharge because they require advanced resources, such as continuous nursing support and life-sustaining medical equipment. Although specific medical conditions do not define participation, many patients depend on mechanical ventilation to breathe. In the hospital setting, these patients are typically confined to neonatal or pediatric intensive care units (NICU/PICU) because "critical care experience" is a mandatory requirement for their management (HICU 202). The program relies on highly trained critical care nurses to deliver 24/7 home-based clinical care for the first several weeks after hospital discharge. This initiative facilitates a safe hospital-to-home transition by providing families with intensive coaching, fostering caregiver confidence, and preparing the child's ongoing care team for long-term medical management (BAYADA Home Health Care, 2025, 2026).

Before implementing the HICU® program, the clinical complexity of these patients often led to significant delays in discharge (HICU 203). High staffing requirements, typically involving round-the-clock care, served as a primary bottleneck (HICU 211). The program enables the transition of children who previously would have remained in the acute setting by establishing additional capacity through clinical protocols, specialized supplies, and communication plans (HICU 118). The higher level of care requires additional financial resources, so BAYADA has individually partnered with multiple payers with VBP agreements.

3.3 METHODOLOGY

Adopting a multi-stakeholder perspective, this study sought to explore the ways in which quality-based payment models intersect with clinical care delivery and related outcomes in a specialized home care environment. The research centered on individuals involved with the BAYADA Home Intensive Care Unit (HICU®) program, employing a qualitative case study approach. Ethical oversight was provided by Lehigh University's Institutional Review Board, and informed consent was obtained from all participants to ensure the protection of privacy and voluntary involvement. To provide a holistic understanding, data were collected from three primary groups: frontline clinicians (nurses), administrative leaders, and caregivers (mothers).

Recruitment was initiated via electronic correspondence, and a protocol of up to three follow-up inquiries was employed to maximize participation and mitigate non-response bias. For the first cohort, the partner organization provided a registry of 56 eligible frontline HICU® nurses; of these, 23 responded, and 21 completed the interview process, yielding a 38% response rate. For the management cohort, a purposive sampling technique was used to identify 17 administrators with direct roles in HICU® clinical supervision, staff training, or VBP negotiations with insurance carriers. Eleven of these managers participated, resulting in a 65% response rate. Finally, a list of 38 eligible parents and guardians who had previously consented to research contact was used to recruit the service recipient cohort, of whom 10 completed the interview, yielding a 26% response rate.

We employed semi-structured interview protocols specifically tailored to the professional or personal context of each cohort to capture a comprehensive view of the

program. These guides incorporated a combination of open-ended and closed-ended questions to facilitate intra-cohort comparisons. Qualitative inquiries across all three cohorts focused on the transition from acute to home-based care, perceived programmatic strengths and weaknesses, and participant-defined benchmarks for clinical success. These were supplemented by cohort-specific closed-ended indicators; for example, nurses were asked to report on changes in time allocation and clinical autonomy, while management provided data on program scalability and VBP engagement. Parents and guardians contributed quantitative ratings regarding their satisfaction with the transition process and the continuity of care following the HICU® intervention.

All interviews were conducted via secure telephonic or video conferencing platforms and were audio recorded after obtaining explicit informed consent. The mean session duration varied significantly by participant type: interviews for nurses averaged 32 minutes (range: 20–53), management sessions averaged 40 minutes (range: 30–55), and parent or guardian sessions averaged 20 minutes (range: 10–36). Subsequent to data collection, all recordings were transcribed verbatim to ensure an accurate foundation for thematic analysis. The research protocol and ethical standards were approved by an academic institutional review board and maintained throughout the recruitment and data management phases to ensure participant confidentiality and data integrity.

To ensure confidentiality, participants were assigned a unique alphanumeric code (e.g., HICU 101). The numeric portions of the identifiers are linked to each interviewed group by the first digit. Nurse interviews begin with the number one,

management interviews begin with the number two, and parent interviews begin with the number three. These identifiers are used throughout to attribute specific quotes to individual participants.

3.4 Analysis: Deductive Qualitative Analysis

The qualitative data obtained from the semi-structured interviews were analyzed using a deductive thematic approach to identify patterns and constructs aligned with the research framework (Fife & Gossner, 2024). The coding process involved iterative refinement, in which initial codes were continuously adjusted to incorporate new observations until thematic saturation was achieved, ensuring that no further novel insights emerged from the data.

After finalizing the formal codebook, two researchers independently coded the transcripts to maintain methodological rigor and minimize individual bias. Inter-rater reliability was rigorously evaluated using Cohen's Kappa, with a target threshold established at (Kappa > 0.80) to signify a high degree of concordance between analysts (Halpin, 2024). Any remaining coding discrepancies were addressed through a discursive consensus-building process, after which all transcripts were systematically re-coded to reflect the unified framework. The primary themes identified through this iterative analysis are summarized in ***Table 3.1*** and are examined in detail in the subsequent findings.

Table 3.1: Primary Themes by Interview Group

	Themes	Nurse	Admin	Parent
Value Metrics	**Benefits**			
✓	Reliability	90%	100%	80%
	Home Healing	90%	82%	80%
	Understanding Needs	81%	73%	90%
	Engagement	90%	73%	90%
	Measuring Success			
	Parent Comfort	90%	82%	100%
✓	Adverse events	86%	100%	70%
	Unmeasured	81%	73%	90%
	Pediatric milestones	38%	0%	60%
	Influencing Factors			
	Training	86%	100%	50%
	Troubleshooting	86%	100%	70%
	Not Hospital	86%	82%	100%
	Family structure	57%	73%	40%
	Challenges			
	Post HICU®	86%	91%	80%
	Nurse Shortage	81%	91%	80%
	External collaboration	71%	100%	50%
✓	Financial Interests	43%	100%	30%
	Strengths			
	Job is rewarding	86%	64%	0%
	Internal Collaboration	95%	91%	40%
	Leadership support	81%	82%	0%
	Bayada provides extra	52%	36%	0%

3.4.1 Mechanisms of Organizational Improvement

Value-Based Purchasing (VBP) serves as a primary external stimulus, compelling a systemic shift in how healthcare entities function by mandate and design. To achieve quality outcomes as defined in the contract, the organization must adjust its internal architecture, moving away from traditional fee-for-service models toward an

integrated care continuum. This evolution is characterized by several specific structural and cultural mechanisms.

3.4.2 Process Redesign and Infrastructure Investment

To align organizational capabilities with VBP requirements, the system undergoes a rigorous process of redesign and infrastructure development. Several key mechanisms characterize this transformation. VBPs rely on incentives for greater coordination across multidisciplinary teams, fostering a culture of shared responsibility and improved communication. This improves the likelihood that clinical outcomes result from an integrated care continuum rather than isolated, disconnected interventions.

The contractual requirement to identify and report outcomes prompts significant investments in health information technology, data sharing, and performance monitoring systems (P. Jain et al., 2025; S. Jain et al., 2019; Leao et al., 2023). These tools are vital for longitudinal tracking and for supporting continuous quality improvement (CQI) initiatives. By establishing a data-driven foundation for evidence-based practice, this infrastructure enables the standardization of clinical processes (Khalil et al., 2025). As a result, unnecessary clinical variation, which has traditionally contributed to excessive costs and inconsistent quality, is effectively reduced (Fisher et al., 2003; Hackbarth, 2012; Sorbero et al., 2014).

Reevaluation of human resources triggers investments in staff with superior skills, practical experience, and advanced training. Program investments in specific, ongoing training and support require sustained effort. As a result of these shifts, the

redesign of care management practices optimizes the delivery system for both precision and clinical efficiency.

3.4.3 Shifting Organizational Culture and Redefining Value

Beyond operational and structural changes, the most significant driver of transformation is the fundamental realignment of organizational culture. Transitioning from a volume-based to a value-based model shifts the institutional focus from maximizing service throughput to prioritizing patient-centered outcomes. Greater clinician engagement and ownership play a crucial role in sustaining this cultural shift. When providers are actively involved in selecting quality metrics and designing contract parameters, they develop a vested interest in advancing the quality agenda. This cultural transformation helps ensure that the organization remains committed to the long-term goal of delivering high-quality, efficient care.

3.5 Defining Success:

A thorough understanding of the value within Value-Based Purchasing (VBP) requires looking beyond just financial savings or measured clinical outcomes. Qualitative evaluations provide evidence that a robust model should account for a broad spectrum of success metrics vital to patients, families, the extended community, and employers. When organizations are encouraged to focus on long-term health and quality of life rather than just the volume of services provided, they shift to a model in which the holistic progress of the patient and family defines success.

Traditional value-based contracts define success primarily in terms of clinical outcomes. As the sponsor of the Hospital Value-Based Purchasing (HVBP) program,

Medicare defined specific measurement categories. These include clinical outcome measures (e.g., mortality rates), patient experience scores, and safety expectations for avoiding unnecessary complications and hospital-associated infections. Recent efforts have also focused on reducing costs by scoring the total spending per Medicare beneficiary (Beauvais et al., 2024; Centers for Medicare & Medicaid Services (CMS), 2026; Zhao et al., 2015).

While BAYADA Home Health Care reports that HICU® participants experienced significantly fewer hospital days, achieved a 25% reduction in rehospitalizations, and generated annual per-child savings of $250,000 (BAYADA Home Health Care, 2026), this study suggests that the program provides additional benefits to children and families that go beyond traditional measures of success. As identified in ***Table 3.1***, only three of the 20 identified qualitative themes corresponded with value-based measures of success.

3.5.1 Operational Success

About 90% of HICU® nurses, 100% of the Bayada management, and 80% of HICU® parents/guardians identified program reliability as a key benefit. As one nurse noted, the importance of "consistent nurses … committed to 24 hours in the beginning and trying not to have scheduling gaps" (HICU 101). Bayada management often expressed great pride in the degree to which the program avoided scheduling gaps compared with a typical home care program. As one person put it, "It's incredible what we have … in the first three weeks, it's [about] 99% staffing reliability. The average reliability for staffing in an outpatient pediatric home case is like 67%. So that means 60% of the time the kid has the appropriate amount. But we give … 99% … and most

of the time it's 100" (HICU 208). One of the nurses who cited reliable coverage as a key benefit of the program emphasized how much the HICU® program improved the situation faced by families with medically complex children. She said that the main benefit was "home care … reliable steady home [care] is so hard to find. So being able to provide a guaranteed, 24-hour day for the first three weeks, and pretty consistent coverage of the day [is important]" (HICU 110).

Our findings are consistent with other studies showing that consistent home nursing care is associated with better physical, mental, and financial well-being, while gaps in care can lead to increased caregiver burden and stress (Boss et al., 2020; Weaver et al., 2018). In these situations, the schedules of home nurses become intertwined with daily family routines, which means unreliable nursing coverage disrupts family life and complicates care, but when nursing care is reliable, families and their children have better experiences (Leyenaar et al., 2017). Importance was positively reinforced with "the ability to know that we have guaranteed care that I could actually do the rest of my life" (HICU 304). Opposingly, one mother reported a gap in evening coverage months post HICU® as, "… now I'm, like, sleep deprived. Like, I can't function during the day. But I have another kid" (HICU 309).

3.5.2 Patient-Centered Success

Our study suggests that the program's benefits for children and families extend beyond conventional metrics of success. We argue that a complete understanding of the program's value should incorporate additional patient-centered benefits while accounting for its burdens on nurses and families.

Nearly all of our respondents argued that home was a better environment for the health of the HICU® children. About 90% of nurses, 82% of Bayada management, and 80% of parents we interviewed discussed the value of healing at home in response to our broad question about the benefits of the HICU® program. According to one of the nurses, it is beneficial to be "… physically, mentally to be at home…surrounded by family and loved ones that you put into, like a regular life kind of routine" (HICU 110). As another nurse explained, "Now I'm seeing families to help, enjoying home life, interacting, bringing the kiddo out into ... the family room to watch, to watch TV. All of their equipment follows them, and they're able to play and be with their family" (HICU 107). Parents went further into the benefits of care at home. "[In the hospital] they're working with a bunch of people on one setting. So this is … more personalized care" (HICU 310). One of the Bayada managers highlighted the value by emphasizing the problem with the alternative. This person argued that, along with the cost of remaining in the hospital, once children are stable, "They'd be getting progressively sicker in the hospital" (HICU 205).

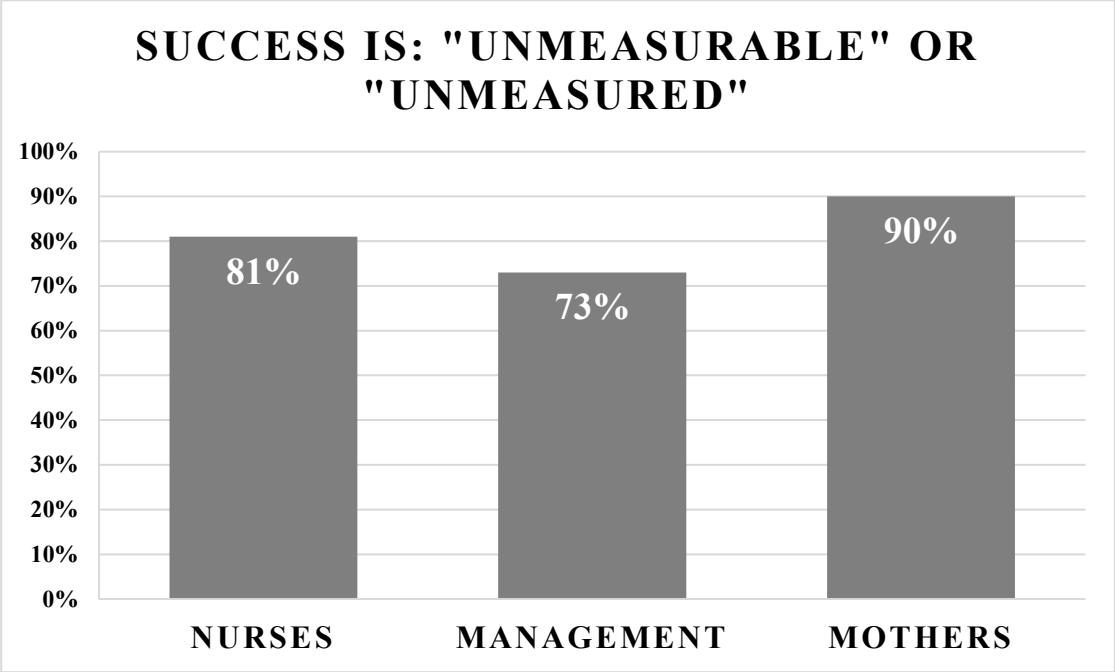


Figure 3.1: Cross Cohort Comparison of Unmeasurable / Unmeasured

Our respondents, particularly the nurses and parents, articulated success metrics that extend beyond traditional clinical indicators. The Bayada management team was largely in agreement but consistently emphasized the importance of reducing days in the hospital. While avoiding adverse events such as hospital readmissions remained important (Kennedy et al., 2023; Maynard et al., 2018), "The biggest metric of success would be … not returning to the hospital" (HICU 109). Our respondents also emphasized less quantifiable outcomes such as family quality of life and developmental milestones (Akin & Pekcici, 2024). About 81% of HICU® nurses, 73% of Bayada management, and 90% of parents reported “unmeasured” or “unmeasurable” benefits of the program. One nurse described such successes with "Family gathering or, like, being able to enjoy experiences that you otherwise wouldn't have been able to in the hospital" (HICU 109). Another said, “A lot of it is hard to

measure kinds of stuff … but there's progress. But I wouldn't know how to [measure it]" (HICU 102).

Improvement in pediatric milestones was a benefit generally absent from VBP, identified by 60% of the parents and about 38% of the nurses. One nurse noted dramatic developmental improvements: "All of the sudden these kids are like walking and like sitting up and holding things and laughing" (HICU 118). When reflecting on the importance of bringing her child home, one mother reported that "being at home and being in a setting outside of the hospital, we [were] able to see her personality more. [She started meeting] some of the social milestones" (HICU 310). Our respondents, particularly the nurses and parents, expressed support for broadening the metrics we use to capture the full value of home-based intensive care programs. This may require going beyond the metrics often included in patient satisfaction surveys to capture how HICU® may improve families' capacity to care for their children.

3.6 DRIVERS OF SUCCESS

Comprehensive interview analysis identified drivers and key elements of success. VBPs provided the financial stability and incentive for Bayada to invest in these systematic organizational improvements.

3.6.1 Partnerships

The Bayada's High Intensity Care Unit (HICU®) program was developed in response to a supportive relationship with the Children's Hospital of Philadelphia (CHOP) and serves as a specialized bridge between acute hospital care and long-term home-based care for medically fragile, technology-dependent children. While CHOP

maintains “the highest standards of discharge” (HICU 209), the partnership addresses critical capacity constraints within the hospital. Specifically, neonatal and pediatric intensive care beds averaged 94% occupancy (U.S. Department of Health & Human Services, 2024), underscoring the need for a safe, high-acuity alternative environment provided by the HICU® program.

The Induced Innovations guided key components of the HICU® pathway, including integrated pre-discharge coordination, medical equipment optimization, professional relationship building, advocacy, and clinical oversight. Unlike standard home care, HICU® staff often engage with the patient and the CHOP clinical team well before discharge. This allows HICU® nurses to "meet the child and the family at the hospital" (HICU 110), ensuring clinical continuity. A critical aspect of the partnership involves synchronizing technology. For example, if a child requires a ventilator, the partnership facilitates the introduction of the home-use program while the child is still inpatient (HICU 108). This process allows for clinical adjustments under hospital supervision before the transition home. Nurses describe the partnership as a collaborative relationship where hospital staff and home care teams learn from one another.

HICU® nurses serve as an extension of hospital expertise, bringing acute care standards into the home setting. Clinical leads are deeply involved in the discharge planning process. These leads serve as advocates for the child and ensure that home care orders and medications are correctly established to prevent untimely readmissions. In some cases, staff identify potential clinical setbacks such as rising respiratory symptoms that could necessitate a delay in discharge for the child's safety.

By maintaining a direct line of contact with the medical team and providing high-level clinical intervention at home, the program can manage complications that would otherwise lead to unnecessary emergency room visits. Establishing these relationships requires significant time and investment to build the necessary value proposition (HICU 211).

3.6.2 Workforce Development

Programmatic success is primarily attributed to the specialized training protocols established for HICU® nursing staff. The majority of nurses (86%) and all management (100%) identify additional training as a primary driver of the program's clinical achievements. This initial training period includes approximately 20 to 25 hours of instruction beyond the standard requirements for home care clinicians. Curricula focus on technical mastery of tracheostomy and ventilator management alongside mentorship regarding the psychosocial challenges of high-acuity environments. While parents emphasized training less frequently than staff did, nearly half of the interviewed parents recognized that HICU® nurses received superior preparation compared to other home care providers. One mother characterized the nursing staff as a hierarchy in which higher compensation reflects their advanced technical capabilities (HICU 303).

At the same time, the fact that a component of HICU® nurse training involves working with children enrolled in the program was seen as a double-edged sword by two of the parents. As one explained, “They use us for training” (HICU 307), yet they eventually recognized the necessity of clinical education for high-quality care. One of the nurses we interviewed acknowledged this tension. As she put it, “And maybe

there's a new nurse who wants to be trained, and maybe the family is kind of like pushing back, like, hey, I don't want new nurses. I get it right. It's like you have a medically fragile child. But that's how nurses learn" (HICU 119).

HICU® nurses receive higher compensation than standard home care clinicians, yet financial incentives are constrained by the broader nursing shortage. Approximately 81% of interviewed nurses identified the labor shortage as a significant programmatic hindrance. One respondent noted, "Home care nursing is the one where you see the most of the nursing shortage" (HICU 118). This limitation creates tensions between program goals and workforce capacity constraints.

Beyond financial compensation, clinicians derive significant rewards from professional pride and emotional fulfillment. Participants described a shared professional identity that distinguishes specialized HICU® teams from general providers. Clinicians expressed satisfaction in being recognized as top-notch providers capable of managing high-acuity patients (HICU 101). This pride is reinforced by the guaranteed nature of the program, which fosters a sense of personal responsibility for patient coverage (HICU 110). The challenge of the work itself is viewed as a reward, as nurses feel fulfilled by meeting the daily demands of a role that is "not easy at all" (HICU 103).

Nurses reported a profound sense of fulfillment when witnessing the tangible progress of their patients, particularly when those milestones occur outside the clinical confines of a hospital. Seeing a child reach a developmental milestone, such as sitting at the dinner table with their family or interacting with siblings after months of isolation, provides a deep sense of professional accomplishment (HICU 110). The

transition from a hospital environment to a "regular life" routine is described as a "huge" and meaningful transformation for both the child and the nurse (HICU 110). Nurses value the opportunity to build collaborative relationships with hospital staff and to serve as educators for families (HICU 110).

Empowering parents to manage complex care is a primary theme within the program. Clinicians observed families transitioning from “high anxiety” to becoming confident clinical advocates (HICU 110). One nurse described the moment a family finally relaxes as an experience akin to repairing shattered glass (HICU 112). Staff find professional fulfillment in offering suggestions that "completely change the trajectory" in the daily quality of life for families (HICU 112). Continuous learning and the impact on a family's life serve as powerful internal motivators for the HICU staff. Nurses value the program because it "keeps us on our toes" and ensures they are "constantly educating" themselves, which they view as a benefit to their personal professional development (HICU 104). Observing a family's happiness when a child stabilizes at home provides an emotional bond that sustains clinician commitment (HICU 104). The knowledge that they are making a lasting difference in a child's life remains a primary driver for nursing retention (HICU 110).

3.6.3 Infrastructural Support

Despite reservations by some parents about being a training site for new nurses, the majority of all respondents, about 86% of the HICU® nurses, all of the Bayada management, and 70% of the parents/guardians, identified the capacity of HICU® nurses to troubleshoot as a strength. HICU® nurses, as supported by their supervisors, were able to intervene to address problems that might otherwise have led

to an ambulance call and an avoidable ED visit. One nurse explained, “I [now] have a good keen sense of assessment and what’s needed and [to identify] what might be subtle changes” (HICU 118). A member of Bayada management was particularly proud of the HICU® nurses' ability to troubleshoot and recommend improvements to the care of the children in the program. This person argued that physicians caring for their clients often accept HICU® nurses' advice when making treatment decisions.

Institutional features, such as Bayada protocols, experienced nurse management backup, and secure communication chats (e.g., for real-time consultation), create a robust support system, making nurses feel they have a team behind them even when working alone. Nearly half of the nurses (48%) and a large majority of the Bayada management (73%) identified the existence of Bayada protocols for addressing common challenges and the availability of an experienced nurse management team as backup as critical institutional features of the program. In addition to written materials and phone calls, HICU® nurses have access to secure chats that facilitate communication among the nursing and management teams. As one nurse explained, “I can read those secure chats and know what I am walking into” (HICU 117). The existence of this infrastructure means that, even though HICU® nurses are alone in the house, they often feel as though they have a team behind them. As another nurse explained, “I know who to reach out to if I don't, specifically my clinical supervisors, I think they are extremely knowledgeable (HICU 103). Another nurse said, “We have a great team of people that we can call and say, I've never been in this situation before, please help me. And never been let down by the answers I've received” (HICU 102).

3.6.4 Mission-Driven Culture and Leadership Support

While this factor appears invisible to parents/guardians, a large majority of HICU® nurses (81%) and Bayada management (82%) identified leadership support as a factor that makes HICU® successful. Along with offering additional pay, investing in nurse training, and providing nursing supervisors who offer advice and assistance to nurses in the home, most of the nurses we interviewed were impressed by Bayada's willingness to go beyond contractual requirements and provide families with what they need. According to one nurse, “You know, they are not afraid, to like, if there's an inaccurate thermometer, [Bayada] will just buy one for the family” (HICU 102). This spirit of going above and beyond extended not only to the company's leadership but also to the HICU® nursing staff. One nurse told us that “some of the nurses were chipping in and trying to buy clothes and do that kind of stuff for the family … trying to, you know, help meet the basic needs of these families” (HICU 112).

While HICU® nurses frequently cited support from Bayada management, the management group often emphasized the organization's leadership. In discussing the organization's willingness to invest in the program and continually work to improve it, multiple members of management emphasized Bayada's mission-driven nature. One person said, “The beauty of the [program] is the fact that we have a compassionate nonprofit behind us” (HICU 205).

3.6.5 Payer Partnerships

Payer engagement is a critical determinant of the fiscal feasibility and scalability of high-acuity home care programs. For insurance carriers, the primary

incentive for HICU® participation is the reduction of the total cost of care by transitioning technology-dependent patients to home settings sooner and more safely (HICU 207). While these partnerships are essential for long-term sustainability, BAYADA frequently initiates HICU® programs by making upfront investments in new markets before securing formal payer agreements (HICU 206). This uniquely proactive investment strategy represents a mission-driven risk, reflecting the organization's commitment to clinical innovation despite the uncertainty of immediate reimbursement.

The inconsistency in payer participation creates significant operational friction for hospital partners. When only a subset of payers agrees to reimburse for HICU® services, clinicians cannot offer the program to all eligible families, which complicates discharge planning and can lead to inequitable care delivery (HICU 203). Furthermore, the lack of payer alignment may force the organization to sunset programs in specific geographic markets if a viable value-based contract cannot be established (HICU 206). Conversely, more progressive payers facilitate program maturation through robust data sharing and the collaborative establishment of clinical benchmarks. These partnerships often utilize shared metrics to track longitudinal outcomes, such as the closure of care gaps among shared members (HICU 203).

Ultimately, the most effective payer partnerships are grounded in a mutual understanding of how specialized home care reduces hospital utilization and overall expenditure. These innovative payers recognize that Value-Based Purchasing provides the necessary framework to support high-intensity resources that deliver superior outcomes, such as reductions in rehospitalizations compared with children not enrolled

in the program (HICU 203, 211). By aligning financial incentives with these expanded success metrics, payers and providers can sustain a clinical continuum that prioritizes the holistic progress of medically fragile children.

3.7 PROGRAMMATIC CHALLENGES

The HICU® program operates within a complex landscape of operational, logistical, and environmental challenges. A primary constraint is the pervasive nursing shortage, a concern identified by 38% of nurses, 82% of leadership, and 60% of parents. Despite enhanced compensation and benefits, recruitment remains difficult in specific markets due to the scarcity of clinicians with the requisite specialized skills (HICU 204).

The professional intensity of high-acuity home care contributes to a substantial personal burden, with 90% of participating nurses reporting significant strain. Logistical factors further exacerbate this pressure, as some clinicians must navigate travel times of up to 90 minutes between their residence and the patient's home (HICU 109, HICU 113). These geographic demands add a layer of physical and temporal exhaustion to an already high-stakes clinical role.

Furthermore, clinical practice in the home setting requires nurses to navigate intricate psychosocial dynamics while providing care to medically fragile children. Clinicians must manage interpersonal tensions and occasional pushback from families who are experiencing high levels of anxiety and stress. These social complexities are often compounded by physical workspace limitations, where intensive care must be

delivered in small, shared bedrooms that lack the controlled infrastructure of a hospital ICU (HICU 109, HICU 113).

Regional market dynamics and the specific structure of state reimbursement models significantly influence the landscape of Value-Based Purchasing for high-acuity home care. A primary challenge to program expansion is the variation between Managed Medicaid and traditional state-fee-for-service Medicaid programs. In markets lacking Managed Medicaid offerings, implementation is notably slower, as negotiating rate changes or novel care programs directly with state agencies can take "several years" (HICU 203).

Furthermore, the long-term sustainability of the HICU® program is sensitive to the fiscal health of public payers. Leadership expressed concerns about the ability of specific payer sources to maintain specialized reimbursement rates amid potential Medicaid budget cuts. The concern of federal funding uncertainty was echoed by at least one parent (HICU 304). Without consistent, high-value reimbursement levels, the financial feasibility of providing intensive, 24-hour nursing support in the home setting remains at risk.

3.8 Policy Implications

Realizing the full potential of Value-Based Purchasing (VBP) requires a fundamental shift in payment structures. Current models often focus narrowly on financial incentives intended to modify individual clinician behavior, but empirical evidence shows these effects are often modest or inconsistent. Instead, policy should

prioritize frameworks that recognize and support systematic, organizational investments and infrastructure development.

3.8.1 Induced Innovation through Regulatory Scarcity

The development of the HICU® program supports exploration of the Porter Hypothesis, which posits that regulatory scarcity can catalyze efficiency and innovation. In the context of pediatric intensive care, the finite number of available hospital beds creates a form of scarcity that compels healthcare entities to discover efficiency offsets (Shain & Roemer, 1959).

Organizations typically optimize for short-term, static efficiency. When a critical resource is capacity constrained, such as a lack of ICU bed availability, it creates a systemic shock that disrupts established routines. This disruption forces organizations to re-examine their entire care delivery process. In this case, the inability to keep clinically stable children in expensive acute care beds revealed that waiting for a bed was an essentially lost opportunity. By innovating to address hospital capacity constraints, BAYADA and its partners developed a program that lowers total costs while simultaneously improving the quality of life for families.

3.8.2 Open Data Mandates for Transparency

A primary barrier to optimizing VBP models is the lack of transparency regarding stakeholder interests and the precise relationship between costs and results. Currently, contractually established proprietary data environments often limit this transparency, obscuring the data necessary for evidence-based investment. Progressive payers facilitate program maturation by sharing data, which directly assists in the

creation of clinical benchmarks. Policymakers should implement open data mandates that require the disclosure of contractual metrics and payments. Standardized data sharing would allow organizations to build robust business cases for long-term investments. Such openness ensures that the patient's holistic progress, rather than short-term service volume, defines clinical success.

3.9 CONCLUSION

The Bayada Home Intensive Care Unit (HICU®) program serves as a definitive example for how Value-Based Purchasing (VBP) can catalyze organizational transformation to produce superior, comprehensive quality outcomes. By linking payment to quality, and not the other way around, the HICU® program demonstrates that clinical and family-centered benefits are best achieved through changes at the organizational level. Robust investments in specialized training, standardized protocols, and multidisciplinary team support drove improvements beyond financial incentives at the individual level. These structural enhancements create an intensive hospital environment within the home, successfully reducing hospital readmissions and emergency room visits.

This research suggests a fundamental redefinition of Value-Based Purchasing, shifting the focus from individual clinician behavior toward the broader organizational environment. Traditional frameworks grounded in Agency Theory often rely on modest financial incentives to motivate clinicians, yet empirical evidence suggests these efforts frequently yield inconsistent results. The primary success of the HICU® program is achieved not through these individual incentives, but through systemic

organizational changes that mandate investment in infrastructure, care coordination, and a mission-driven culture of quality.

A complete understanding of program value must also incorporate "additional benefits" that extend beyond traditional financial savings or measured clinical indicators. Qualitative evidence underscores the importance of patient-centered outcomes, such as the restoration of family life, the attainment of developmental milestones, and the psychological relief of "healing at home," as vital metrics of success. Capturing the full value of home-based intensive care requires broadening evaluation metrics to include families' expanded capacity to care for their children. Ultimately, the sustainability of such innovations depends on defining all stakeholders and aligning their interests within a transparent framework. Programs such as BAYADA's HICU® have the potential to reduce costs, enhance appropriate access to high-level resources for those with the greatest need, and improve quality, whether defined by traditional metrics or by benefits that are less easily quantified.

REFERENCES

AHIP. (2026). *2025 Alternative Payment Model (APM) Measurement Effort: Methodology and Results Report*. https://ahiporg-production.s3.amazonaws.com/documents/2025_APM-Methodology_Report.pdf

Akin, E., & Pekcici, B. (2024). Monitoring and supporting development in children on home invasive mechanical ventilation. *Pediatric Pulmonology*, *59*(8). https://doi.org/10.1002/ppul.26876

American Hospital Association. (2018). *AHA Annual Survey Database: Fiscal Year 2017*. Health Forum, LLC. https://www.ahadata.com/

Avey, J. B., Avolio, B. J., Crossley, C. D., & Luthans, F. (2009). Psychological ownership: theoretical extensions, measurement and relation to work outcomes. *Journal of Organizational Behavior*, *30*(2), 173–191. http://www.jstor.org/stable/41683824

Banerjee, S., McCormick, D., Paasche-Orlow, M. K., Lin, M.-Y., & Hanchate, A. D. (2019). Association between degree of exposure to the Hospital Value Based Purchasing Program and 30-day mortality: Experience from the first four years of Medicare's pay-for-performance program. *BMC Health Services Research*, *19*(1), 921. https://doi.org/10.1186/s12913-019-4562-7

BAYADA Home Health Care. (2024). *2024 annual report*. https://www.bayada.com

BAYADA Home Health Care. (2025). *Pediatric home health*. https://www.bayada.com/pediatric-home-health

BAYADA Home Health Care. (2026, January 26). *Home Intensive Care Unit (HICU®): Pediatric care at home*. https://www.bayada.com/home-intensive-care-unit

Beauvais, B., Pradhan, R., Ramamonjiarivelo, Z., Mileski, M., & Shanmugam, R. (2024). When agency fails: An analysis of the association between hospital agency staffing and quality outcomes. *Risk Management and Healthcare Policy*, *17*, 1361–1372. https://doi.org/10.2147/RMHP.S459840

Berwick, D. M., Nolan, T. W., & Whittington, J. (2008). The Triple Aim: Care, Health, and Cost. *Health Affairs*, *27*(3), 759–769. https://doi.org/10.1377/hlthaff.27.3.759

Bhattacharyya, T., Mehta, P., & Freiberg, A. A. (2008). Hospital characteristics associated with success in a pay-for-performance program in orthopaedic surgery. *Journal of Bone and Joint Surgery*, *90*(6), 1240–1243. https://doi.org/10.2106/JBJS.G.01172

Borah, B. J., Rock, M. G., Wood, D. L., Roellinger, D. L., Johnson, M. G., & Naessens, J. M. (2012). Association between value-based purchasing score and hospital characteristics. *BMC Health Services Research*, *12*, 464. https://doi.org/10.1186/1472-6963-12-464

Boss, R., Raisanen, J., Detwiler, K., Fratantoni, K., Huff, S., Neubauer, K., & Donohue, P. (2020). Lived experience of pediatric home health care among families of children with medical complexity. *Clinical Pediatrics*, *59*(2), 178–187. https://doi.org/10.1177/0009922819894006

Boylan, M. R., Suchman, K. I., Korolikova, H., Slover, J. D., & Bosco, J. A. (2019). Association of magnet nursing status with hospital performance on nationwide quality metrics. *Journal for Healthcare Quality*, *41*(4), 189–194. https://doi.org/10.1097/JHQ.0000000000000202

Büchner, V. A., Hinz, V., & Schreyögg, J. (2016). Health systems: changes in hospital efficiency and profitability. *Health Care Management Science*, *19*(2), 130–143. https://doi.org/10.1007/s10729-014-9303-1

Carayon, P., Schoofs Hundt, A., Karsh, B.-T., Gurses, A. P., Alvarado, C. J., Smith, M., & Flatley Brennan, P. (2006). Work system design for patient safety: the SEIPS model. *Quality in Health Care*, *15*(suppl 1), i50–i58. https://doi.org/10.1136/qshc.2005.015842

Carroll, N. W., & Clement, J. P. (2021). Hospital performance in the first 6 years of Medicare's value-based purchasing program. *Medical Care Research and Review*, *78*(5), 598–606. https://doi.org/10.1177/1077558720927586

Cattel, D., & Eijkenaar, F. (2019). Value-based provider payment initiatives combining global payments with explicit quality incentives: A systematic review. *Medical Care Research and Review*, *77*(6), 511–537. https://doi.org/10.1177/1077558719856775

Centers for Medicare & Medicaid Services. (2016). *2017 Reporting Cycle Teaching Hospital List (September 2016)*.

Centers for Medicare & Medicaid Services. (2017a). *Medicare Inpatient Hospital Look-up Tool*.

Centers for Medicare & Medicaid Services. (2017b). *Provider of Services File: Hospital & Non-Hospital Facilities (Q4 2017)*.

Centers for Medicare & Medicaid Services. (2024). Medicare and Medicaid programs and the Children's Health Insurance Program; Hospital inpatient prospective payment systems for acute care hospitals and the long-term care hospital prospective payment system and policy changes and fiscal year 2025 rates; Quality programs requirements; and other policy changes. *Federal Register*, *89*(167), 68986–70046. https://www.federalregister.gov/d/2024-17021

Centers for Medicare & Medicaid Services. (2025a). *Medicare program; Hospital Inpatient Prospective Payment Systems for acute care hospitals and the Long-Term Care Hospital Prospective Payment System and policy changes and fiscal year 2026 rates; requirements for quality programs; and other policy changes*. https://www.federalregister.gov/documents/2025/04/30/2025-09382/medicare-

program-hospital-inpatient-prospective-payment-systems-for-acute-care-hospitals-and-the

Centers for Medicare & Medicaid Services. (2025b). *National Health Expenditures by type of service and source of funds, CY 1960–2023*. Office of the Actuary (OACT). https://www.cms.gov/files/zip/national-health-expenditures-type-service-and-source-funds-cy-1960-2023.zip

Centers for Medicare & Medicaid Services. (2025c, June 24). *NHE fact sheet*. https://www.cms.gov/data-research/statistics-trends-and-reports/national-health-expenditure-data/nhe-fact-sheet

Centers for Medicare & Medicaid Services (CMS). (2026). *FY 2026 Hospital VBP program summary: Highlights of the fiscal year percentage payment summary report*. https://qualitynet.cms.gov/inpatient/hvbp/resources

Centers for Medicare & Medicaid Services (CMS), HHS. (2011). Medicare program; hospital inpatient value-based purchasing program. Final rule. *Federal Register*, *76*(88), 26490–26547. http://www.ncbi.nlm.nih.gov/pubmed/21548401

Chaix-Couturier, C., Durand-Zaleski, I., Jolly, D., & Durieux, P. (2000). Effects of financial incentives on medical practice: results from a systematic review of the literature and methodological issues. *International Journal for Quality in Health Care*, *12*(2), 133–142. https://doi.org/10.1093/intqhc/12.2.133

Chatterjee, P., & Joynt Maddox, K. E. (2018). US National Trends in Mortality From Acute Myocardial Infarction and Heart Failure. *JAMA Cardiology*, *3*(4), 336. https://doi.org/10.1001/jamacardio.2018.0218

Chee, T. T., Ryan, A. M., Wasfy, J. H., & Borden, W. B. (2016). Current state of value-based purchasing programs. *JAMA*, *315*(20), 2145–2146. https://doi.org/10.1001/jama.2016.1922

Chen, C., Chung, Y., Petterson, S., & Bazemore, A. (2020). Changes and Variation in Medicare Graduate Medical Education Payments. *JAMA Internal Medicine*, *180*(1), 148. https://doi.org/10.1001/jamainternmed.2019.4429

Congressional Budget Office. (2023). *Federal Budgetary Effects of the Activities of the Center for Medicare & Medicaid Innovation*. https://www.cbo.gov/publication/59612

Conrad, D. A. (2015). The theory of value-based payment incentives and their application to health care. *Health Services Research*, *50*, 2057–2089. https://doi.org/10.1111/1475-6773.12408

Coussens, S., & Ly, D. P. (2025). Variation in Emergency Department Physician Admitting Practices and Subsequent Mortality. *JAMA Internal Medicine*, *185*(2), 153–160. https://doi.org/10.1001/jamainternmed.2024.6925

Cowan, N. (2001). The magical number 4 in short-term memory: A reconsideration of mental storage capacity. *Behavioral and Brain Sciences*, *24*(1), 87–114. https://doi.org/10.1017/S0140525X01003922

Crump, R. K., Hotz, V. J., Imbens, G. W., & Mitnik, O. A. (2009). Dealing with limited overlap in estimation of average treatment effects. *Biometrika*, *96*(1), 187–199. https://doi.org/10.1093/biomet/asn055

Department of the Treasury Internal Revenue Service. (2024). *Instructions for Schedule H (Form 990) Hospitals*. https://www.irs.gov/pub/irs-pdf/i990sh.pdf

Dierkes, A. M., Riman, K., Daus, M., Germack, H. D., & Lasater, K. B. (2021). The Association of Hospital Magnet® Status and Pay-for-Performance Penalties. *Policy, Politics, and Nursing Practice*, *22*(4), 245–252. https://doi.org/10.1177/15271544211053854

Donabedian, A. (1966). Evaluating the quality of medical care. *The Milbank Memorial Fund Quarterly*, *44*(3), 166–206. https://doi.org/10.2307/3348969

Donabedian, A. (1988). The Quality of Care. *JAMA*, *260*(12), 1743. https://doi.org/10.1001/jama.1988.03410120089033

Eijkenaar, F., & Schut, F. T. (2015). Value-based payment initiatives combining global payments with explicit quality incentives. *Health Policy*, *119*(11), 1405–1413. https://doi.org/10.1016/j.healthpol.2015.09.004

Eisenhardt, K. M. (1989). Agency Theory: An assessment and review. *Academy Management Review*, *14*(1), 57–74.

Emanuel, E. J., Ubel, P. A., Kessler, J. B., Meyer, G., Muller, R. W., Navathe, A. S., Patel, M. S., Pearl, R., Rosenthal, M. B., Sacks, L., Sen, A. P., Sherman, P., & Volpp, K. G. (2016). Using behavioral economics to design physician incentives that deliver high-value care. *Annals of Internal Medicine*, *164*, 114–119. https://doi.org/10.7326/m15-1330

Fife, S. T., & Gossner, J. D. (2024). Deductive qualitative analysis: Evaluating, expanding, and refining theory. *International Journal of Qualitative Methods*, *23*. https://doi.org/10.1177/16094069241244856

Figueroa, J. F., Tsugawa, Y., Zheng, J., Orav, E. J., & Jha, A. K. (2016). Association between the Value-Based Purchasing pay for performance program and patient mortality in US hospitals: observational study. *BMJ*, i2214. https://doi.org/10.1136/bmj.i2214

Fimognari, F. L., Lelli, D., Landi, F., & Antonelli Incalzi, R. (2022). Association of age with emergency department visits and hospital admissions: A nationwide study. *Geriatrics & Gerontology International*, *22*(11), 917–923. https://doi.org/10.1111/ggi.14481

Fiscal year (FY) 2027 hospital value-based purchasing (VBP) program quick reference guide. (2024).

https://www.qualityreportingcenter.com/globalassets/2025/01/iqr/fy2027_hospital vbp-quick-reference-guide.pdf

Fisher, E. S., Wennberg, D. E., Stukel, T. A., Gottlieb, D. J., Lucas, F. L., & Pinder, É. L. (2003). The implications of regional variations in Medicare spending. Part 1: The content, quality, and accessibility of care. *Annals of Internal Medicine*, *138*(4), 273–287. https://doi.org/10.7326/0003-4819-138-4-200302180-00006

Flood, A. B. (1994). The Impact of Organizational and Managerial Factors on the Quality of Care in Health Care Organizations. *Medical Care Review*, *51*(4), 381–428. https://doi.org/10.1177/107755879405100402

Florida Agency for Health Care Administration. (2017a). *Emergency Department (ED) Patient Data: 2017*. https://quality.healthfinder.fl.gov/Researchers/Order-Data/

Florida Agency for Health Care Administration. (2017b). *Facility/Provider Search: Hospitals*.

Florida Agency for Health Care Administration. (2017c). *Florida Hospital Inpatient Discharge Data: 2017*. https://quality.healthfinder.fl.gov/Researchers/Order-Data/

Frølich, A., Talavera, J., Broadhead, P., & Dudley, R. A. (2007). A behavioral model of clinician responses to incentives to improve quality. *Health Policy*, *80*, 179–193. https://doi.org/10.1016/j.healthpol.2006.03.001

Gajic, O., Afessa, B., Hanson, A. C., Krpata, T., Yilmaz, M., Mohamed, S. F., Rabatin, J. T., Evenson, L. K., Aksamit, T. R., Peters, S. G., Hubmayr, R. D., & Wylam, M. E. (2008). Effect of 24-hour mandatory versus on-demand critical care specialist presence on quality of care and family and provider satisfaction in the intensive care unit of a teaching hospital*. *Critical Care Medicine*, *36*(1), 36–44. https://doi.org/10.1097/01.CCM.0000297887.84347.85

Gasparini, A. (2018). comorbidity: An R package for computing comorbidity scores. *Journal of Open Source Software*, *3*(23), 648. https://doi.org/10.21105/joss.00648

Hackbarth, A. D. (2012). Eliminating waste in US health care. *JAMA*, *307*(14), 1513. https://doi.org/10.1001/jama.2012.362

Hajjaj, F. M., Salek, M. S., Basra, M. K. A., & Finlay, A. Y. (2010). Non-clinical influences on clinical decision-making: a major challenge to evidence-based practice. *Journal of the Royal Society of Medicine*, *103*(5), 178–187. https://doi.org/10.1258/jrsm.2010.100104

Halpin, S. N. (2024). Inter-coder agreement in qualitative coding: Considerations for its use. *American Journal of Qualitative Research*, *8*(3), 23–43. https://doi.org/10.29333/ajqr/14810

Hamadi, H., Apatu, E., & Spaulding, A. (2018). Does hospital ownership influence hospital referral region health rankings in the United States. *International Journal of Health Planning and Management*, *33*(1), e168–e180. https://doi.org/10.1002/hpm.2442

Hamadi, H. Y., Martinez, D., Palenzuela, J., & Spaulding, A. C. (2021). Magnet Hospitals and 30-Day Readmission and Mortality Rates for Medicare Beneficiaries. *Medical Care*, *59*(1), 6–12. https://doi.org/10.1097/MLR.0000000000001427

Handy, F., & Katz, E. (1998). The Wage Differential between Nonprofit Institutions and Corporations: Getting More by Paying Less? *Journal of Comparative Economics*, *26*(2), 246–261. https://doi.org/10.1006/jcec.1998.1520

Health Care Payment Learning & Action Network. (2025, August 22). *Health care payment learning & action network - quality care, improved health, and lower costs*. https://hcp-lan.org/apm-measurement-effort/2023-apm/

Heath, C., & Sitkin, S. B. (2001). Big-B versus Big-O: What is organizational about Organizational Behavior? *Journal of Organizational Behavior*, *22*(1), 43–58. http://www.jstor.org/stable/3649606

Hong, Y.-R., Nguyen, O., Yadav, S., Etzold, E., Song, J., Duncan, R. P., & Turner, K. (2020). Early performance of Hospital Value-based Purchasing Program in Medicare. *Medical Care*, *58*(8), 734–743. https://doi.org/10.1097/mlr.0000000000001354

Hsu, H. E., Wang, R., Broadwell, C., Horan, K., Jin, R., Rhee, C., & Lee, G. M. (2020). Association between federal value-based incentive programs and health care–associated infection rates in safety-net and non–safety-net hospitals. *JAMA Network Open*, *3*(7), e209700. https://doi.org/10.1001/jamanetworkopen.2020.9700

Jain, P., Jain, B., Hammond, A., Sabet, C. J., Rahim, F. O., Patel, T. A., Jain, U., Batra, M., & Lewis, S. (2025). Value-based care: Lessons for the United Kingdom's National Health Service. *Value in Health*, *28*(9), 1309–1316. https://doi.org/10.1016/j.jval.2025.06.003

Jain, S., Thorpe, K., Hockenberry, J., & Saltman, R. (2019). Strategies for delivering value-based care: Do care management practices improve hospital performance? *Journal of Healthcare Management*, *64*(6), 399–413. https://doi.org/10.1097/jhm-d-18-00049

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/https://doi.org/10.1016/0304-405X(76)90026-X

Jones, C. W., Sonnad, S. S., Augustine, J. J., & Reese, C. L. (2014). Overall ED efficiency is associated with decreased time to percutaneous coronary intervention for ST-segment elevation myocardial infarction. *The American Journal of Emergency Medicine*, *32*(10), 1189–1194. https://doi.org/10.1016/j.ajem.2014.07.006

Jones, W. S., Mulder, H., Wruck, L. M., Pencina, M. J., Kripalani, S., Muñoz, D., Crenshaw, D. L., Effron, M. B., Re, R. N., Gupta, K., Anderson, R. D., Pepine, C.

J., Handberg, E. M., Manning, B. R., Jain, S. K., Girotra, S., Riley, D., DeWalt, D. A., Whittle, J., … Hernandez, A. F. (2021). Comparative effectiveness of aspirin dosing in cardiovascular disease. *New England Journal of Medicine*, *384*(21), 1981–1990. https://doi.org/10.1056/NEJMoa2102137

Kennedy, H., Cole, A., Berbert, L., Schenkel, S., & DeGrazia, M. (2023). An examination of characteristics, social supports, caregiver resilience and hospital readmissions of children with medical complexity. *Child: Care, Health and Development*, *49*(5), 920–929. https://doi.org/10.1111/cch.13206

Khalil, H., Ameen, M., Davies, C., & Liu, C. (2025). Implementing value-based healthcare: A scoping review of key elements, outcomes, and challenges for sustainable healthcare systems. *Frontiers in Public Health*, *13*, 1514098. https://doi.org/10.3389/fpubh.2025.1514098

Koenig, L., Soltoff, S. A., Demiralp, B., Demehin, A. A., Foster, N. E., Steinberg, C. R., Vaz, C., Wetzel, S., & Xu, S. (2017). Complication Rates, Hospital Size, and Bias in the CMS Hospital-Acquired Condition Reduction Program. *American Journal of Medical Quality*, *32*(6), 611–616. https://doi.org/10.1177/1062860616681840

Kroeber, A. L., & Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. *Papers. Peabody Museum of Archaeology & Ethnology, Harvard University*, *47*(1).

Kushel, M. B., Gupta, R., Gee, L., & Haas, J. S. (2006). Housing instability and food insecurity as barriers to health care among low-income americans. *Journal of General Internal Medicine*, *21*(1), 71–77. https://doi.org/10.1111/j.1525-1497.2005.00278.x

Larburu, N., Azkue, L., & Kerexeta, J. (2023). Predicting Hospital Ward Admission from the Emergency Department: A Systematic Review. *Journal of Personalized Medicine*, *13*(5), 849. https://doi.org/10.3390/jpm13050849

Leao, D., Cremers, H., Van Veghel, D., Pavlova, M., & Groot, W. (2023). The impact of value-based payment models for networks of care and transmural care: A systematic literature review. *Applied Health Economics and Health Policy*, *21*(3), 391–407. https://doi.org/10.1007/s40258-023-00790-z

Leyenaar, J., O'Brien, E., Leslie, L., Lindenauer, P., & Mangione-Smith, R. (2017). Families' priorities regarding hospital-to-home transitions for children with medical complexity. *Pediatrics*, *139*(1). https://doi.org/10.1542/peds.2016-1581

Li, J. (2022). Value-based payments in health care: Evidence from a nationwide randomized experiment in the home health sector. *Journal of Policy Analysis and Management*, *41*(4), 1054–1081. https://doi.org/10.1002/pam.22415

Madden, B. (2025, April 24). *The top 20 and top 80 health systems by total revenue, patient revenue, and revenue growth as of December 31, 2024 financials*. https://hospitalogy.com/articles/2025-04-24/top-health-systems-by-revenue-2024/

Mathes, T., Pieper, D., Morche, J., Polus, S., Jaschinski, T., & Eikermann, M. (2019). Pay for performance for hospitals. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.CD011156.pub2

Maynard, R., Christensen, E., Cady, R., Jacob, A., Ouellette, Y., Podgorski, H., Schiltz, B., Schwantes, S., & Wheeler, W. (2018). Home health care availability and discharge delays in children with medical complexity. *Pediatrics*, *143*(1). https://doi.org/10.1542/peds.2018-1951

McKenzie, M. S., Auriemma, C. L., Olenik, J., Cooney, E., Gabler, N. B., & Halpern, S. D. (2015). An observational study of decision making by medical intensivists. *Critical Care Medicine*, *43*(8). https://journals.lww.com/ccmjournal/fulltext/2015/08000/an_observational_study_of_decision_making_by.14.aspx

Medicaid, Payment, C., & Commission, A. (2017). *Medicaid Hospital Payment: A Comparison across States and to Medicare*. https://www.macpac.gov/wp-content/uploads/2017/04/Medicaid-Hospital-Payment-A-Comparison-across-States-and-to-Medicare.pdf

Mendelson, A., Kondo, K., Damberg, C., Low, A., Motúpuaka, M., Freeman, M., O'Neil, M., Relevo, R., & Kansagara, D. (2017). The effects of pay-for-performance programs on health, health care use, and processes of care. *Annals of Internal Medicine*, *166*(5), 341–353. https://doi.org/10.7326/m16-1881

Menser, T., Hamadi, H. Y., Boamah, S. A., Dorsey, K., Zhao, M., & Spaulding, A. (2023). The role of community-level characteristics in comparing United States hospital performance by magnet designation: A propensity score matched study. *Journal of Advanced Nursing*, *79*(5), 1939–1948. https://doi.org/10.1111/jan.15446

Moore, B. J., White, S., Washington, R., Coenen, N., & Elixhauser, A. (2017). Identifying increased risk of readmission and in-hospital mortality using hospital administrative data. *Medical Care*, *55*(7), 698–705. https://doi.org/10.1097/MLR.0000000000000735

Muhlestein, D., Tu, T., de Lisle, K., & Merrill, T. (2016). Hospital participation in ACOs associated with other value-based program improvement. *The American Journal of Managed Care*, *22*(7), e241-8.

Noghrehchi, P., Hefner, J. L., & Walker, D. M. (2024). The relationship between hospital patient safety culture and performance on Centers for Medicare & Medicaid Services value-based purchasing metrics. *Health Care Management Review*, *49*(4), 281–290.

Nuckols, T. K., Fingar, K. R., Barrett, M., Steiner, C. A., Stocks, C., & Owens, P. L. (2017). The shifting landscape in utilization of inpatient, observation, and emergency department services across payers. *Journal of Hospital Medicine*, *12*(6), 443–446.

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … McKenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ*, n160. https://doi.org/10.1136/bmj.n160

Pardoe, I., Simon, L., & Young, D. (2018). *10.7 - Detecting Multicollinearity Using Variance Inflation Factors*. https://online.stat.psu.edu/stat462/node/180/

Petersen, L. A., Simpson, K., Pietz, K., Urech, T. H., Hysong, S. J., Profit, J., Conrad, D. A., Dudley, R. A., & Woodard, L. C. D. (2013). Effects of individual physician-level and practice-level financial incentives on hypertension care: A randomized trial. *JAMA*, *310*(10), 1042–1050. https://doi.org/10.1001/jama.2013.276303

Petersen, L. A., Woodard, L. D., Urech, T., Daw, C., & Sookanan, S. (2006). Does pay-for-performance improve the quality of health care? *Annals of Internal Medicine*, *145*(4), 265–272. https://doi.org/10.7326/0003-4819-145-4-200608150-00006

Pfeffer, J., & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.

Pierce, J. L., Kostova, T., & Dirks, K. T. (2001). Toward a Theory of Psychological Ownership in Organizations. *Academy of Management Review*, *26*(2), 298–310. https://doi.org/10.5465/amr.2001.4378028

Porter, M. E., & Lee, T. H. (2013). The strategy that will fix health care. *Harvard Business Review*, *91*(10), 50–70. https://hbr.org/2013/10/the-strategy-that-will-fix-health-care

Raftery, A. E. (1995). Bayesian model selection in social research. *Sociological Methodology*, *25*, 111–163. https://doi.org/10.2307/271063

Rosenbaum, S. (2011). The Patient Protection and Affordable Care Act: implications for public health policy and practice. *Public Health Rep.*, *126*(1), 130–135.

Ryan, A. M., Krinsky, S., Maurer, K. A., & Dimick, J. B. (2017). Changes in Hospital Quality Associated with Hospital Value-Based Purchasing. *New England Journal of Medicine*, *376*(24), 2358–2366. https://doi.org/10.1056/nejmsa1613412

Sautter, K. M., Bokhour, B. C., White, B., Min, D., Young, G. J., Burgess, J. F., Berlowitz, D., & Wheeler, J. R. C. (2007). The early experience of a Hospital-Based Pay-for-Performance Program. *Journal of Healthcare Management*, *52:2*(March/April), 95–107.

Shain, M., & Roemer, M. I. (1959). Hospital costs relate to the supply of beds. *The Modern Hospital*, *92*(4), 71–73, 168.

Simon, H. A. (1955). A behavioral model of rational choice. *The Quarterly Journal of Economics*, *69*(1), 99–118.

Smulowitz, P. B., Honigman, L., & Landon, B. E. (2013). A Novel Approach to Identifying Targets for Cost Reduction in the Emergency Department. *Annals of Emergency Medicine*, *61*(3), 293–300. https://doi.org/10.1016/j.annemergmed.2012.06.014

Smulowitz, P. B., O'Malley, A. J., McWilliams, J. M., Zaborski, L., & Landon, B. E. (2021). Variation in Rates of Hospital Admission from the Emergency Department Among Medicare Patients at the Regional, Hospital, and Physician Levels. *Annals of Emergency Medicine*, *78*(4), 474–483. https://doi.org/10.1016/j.annemergmed.2021.03.027

Sorbero, M. E., Martsolf, G. R., Mandel, D., Lovejoy, S. L., Damberg, C. L., & Raaen, L. (2014). Measuring success in health care value-based purchasing programs: Analysis and recommendations. In *RAND Corporation Policy Commons*. https://policycommons.net/artifacts/4834883/measuring-success-in-health-care-value-based-purchasing-programs/5671602/

Spaulding, A., Edwardson, N., & Zhao, M. (2018). Hospital value-based purchasing performance: Do organizational and market characteristics matter? *Journal of Healthcare Management*, *63*(1), 31–48. https://doi.org/10.1097/JHM-D-16-00015

Spaulding, A., Hamadi, H., Moody, L. R., Lentz, L., Liu, X. A., & Wu, Y. J. (2020). Do Magnet®-Designated Hospitals Perform Better on Medicare's Value-Based Purchasing Program? *Journal of Nursing Administration*, *50*(7–8), 395–401. https://doi.org/10.1097/NNA.0000000000000906

Spaulding, A., Zhao, M., & Haley, D. R. (2014). Value-based purchasing and hospital acquired conditions: Are we seeing improvement? *Health Policy*, *118*(3), 413–421. https://doi.org/10.1016/j.healthpol.2014.10.003

U.S. Department of Health & Human Services. (2024). *COVID-19 reported patient impact and hospital capacity by facility*. https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/anag-cw7u

Van Dyne, L., & Pierce, J. L. (2004). Psychological ownership and feelings of possession: three field studies predicting employee attitudes and organizational citizenship behavior. *Journal of Organizational Behavior*, *25*(4), 439–459. https://doi.org/10.1002/job.249

Vella, K. M., Hall, A. K., Van Merrienboer, J. J. G., Hopman, W. M., & Szulewski, A. (2021). An exploratory investigation of the measurement of cognitive load on shift: Application of cognitive load theory in emergency medicine. *AEM Education and Training*, *5*(4), e10634. https://doi.org/10.1002/aet2.10634

Vina, E. R., Rhew, D. C., Weingarten, S. R., Weingarten, J. B., & Chang, J. T. (2009). Relationship between organizational factors and performance among pay-for-

performance hospitals. *Journal of General Internal Medicine*, *24*(7), 833–840. https://doi.org/10.1007/s11606-009-0997-6

Vlaanderen, F. P., Tanke, M. A., Bloem, B. R., Faber, M. J., Eijkenaar, F., Schut, F. T., & Jeurissen, P. P. T. (2019). Design and effects of outcome-based payment models in healthcare: a systematic review. *The European Journal of Health Economics*, *20*(2), 217–232. https://doi.org/10.1007/s10198-018-0989-8

von Bertalanffy, L. (1968). *General System Theory: Foundations, Development, Applications*. George Braziller.

Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., Vandenbroucke, J. P., & STROBE Initiative. (2008). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Journal of Clinical Epidemiology*, *61*(4), 344–349. https://doi.org/10.1016/j.jclinepi.2007.11.008

Vrieze, S. I. (2012). Model selection and psychological theory: A discussion of the differences between the Akaike information criterion (AIC) and the Bayesian information criterion (BIC). *Psychological Methods*, *17*(2), 228–243. https://doi.org/10.1037/a0027127

Walker, D. M., Mora, A. M., Hogan, T. H., & others. (2018). Assessing Trends in Hospital System Structures From 2008 to 2015. *Medical Care*, *56*(10), 831–839. https://doi.org/10.1097/MLR.0000000000000977

Weaver, M., Wichman, B., Bace, S., Schroeder, D., Vail, C., Wichman, C., & Macfadyen, A. (2018). Measuring the impact of the home health nursing shortage on family caregivers of children receiving palliative care. *Journal of Hospice and Palliative Nursing*, *20*(3), 260–265. https://doi.org/10.1097/NJH.0000000000000436

White, C., & Whaley, C. M. (2019). *Detailed Data [Supplemental material to Prices Paid to Hospitals by Private Health Plans Are High Relative to Medicare and Vary Widely: Findings from an Employer-Led Transparency Initiative]* (Number RR-3033-RWJ). https://www.rand.org/pubs/research_reports/RR3033.html

Williams, C., Asi, Y., Raffenaud, A., Bagwell, M., & Zeini, I. (2016). The effect of information technology on hospital performance. *Health Care Management Science*, *19*(4), 338–346. https://doi.org/10.1007/s10729-015-9329-z

Wynn, B. O., Smalley, R., & Cordasco, K. M. (2013). Does It Cost More to Train Residents or to Replace Them?: A Look at the Costs and Benefits of Operating Graduate Medical Education Programs. *Rand Health Quarterly*, *3*(3), 7.

Zhao, M., Haley, D. R., Spaulding, A., & Balogh, H. A. (2015). Value-based purchasing, efficiency, and hospital performance. *Health Care Manager*, *34*(1), 4–13. https://doi.org/10.1097/HCM.0000000000000048

APPENDICES FOR ARTICLE 1: BEYOND MEDICAL NECESSITY: A MULTI-LEVEL SYSTEMS ANALYSIS OF EMERGENCY DEPARTMENT ADMISSIONS

APPENDIX 1.1: CONSTRUCTED VARIABLES

Datasets from CMS and Florida's Health Care Transparency website were used to identify and correct provider misidentification in the AHCA Inpatient and ED data files (Centers for Medicare & Medicaid Services, 2017a, 2017b; Florida Agency for Health Care Administration, 2017b).

Elixhauser Comorbidity Index was calculated from ICD-10 codes to create a numeric value from 38 conditions that could range from -19 to +89 with this dataset range (-18.00,73.00) and a median of 12.85. The variable combines clinical variation into a single value and has been modeled for care intensity and risk (Gasparini, 2018; Moore et al., 2017).

To ensure a precise classification of academic medical centers, this study defines **hospital teaching status** using the 2017 CMS Open Payments Teaching Hospital List rather than broader self-reported indicators from the AHA survey. This registry isolates institutions with active, federally-verified training programs receiving Direct Graduate Medical Education (GME) or Indirect Medical Education (IME) payments and links across datasets using the unique Certification Number (CCN) from CMS (Centers for Medicare & Medicaid Services, 2016).The AHA self-reported data included 95% of the hospitals as teaching facilities; whereas, the CMS reported data limited representation to 22% of the Florida hospitals.

An **inpatient payment estimate** for potential revenue was created to evaluate the impact of an external financial influence on hospital admission. The 2017 CMS Provider Utilization and Payment Public Use File supported the creation of the variable with Florida-specific reimbursement data for Original Medicare Part A beneficiaries. Data are aggregated at the service-line level using Medicare Severity Diagnosis-Related Group (MS-DRG) classifications, tracking total discharge volumes alongside actualized payment amounts inclusive of beneficiary deductibles and coinsurance. Each primary diagnosis code received a weighted dollar value relative to its DRG-linked frequency. Economic variability is significant across services, with weighted average total payments per discharge of $11,489 *(Medicaid et al., 2017)*. Per the RAND Corporation assessment, commercial insurers paid an average 193% more for inpatient services in Florida in 2017 *(White & Whaley, 2019)*. Given the payer mix identified from the AHCA inpatient dataset, the estimated average payment for inpatient services would increase to approximately $14,000.

The **Occupancy** variable was generated using the inpatient dataset. The hospital-specific daily census was first determined by tracking longitudinal admissions from December 8, 2011, through December 31, 2017. By subtracting daily discharges starting on January 1, 2017, from new admissions, the specific census for each day was established. This value was then divided by the hospital's staffed beds to calculate the occupancy and expressed as a percentage. The dataset exhibits a potential drop-off in observations during the month of December. Because the data is based on 2017 discharges, patients admitted in late December 2017 who were not discharged until 2018 are excluded. Consequently, this study does not include admissions where the

hospital stays spanned across the calendar year boundary. All models using occupancy variables additionally included the fixed effects of the encounter Month.

Based on a preliminary evaluation of the data, there was an observable decrease in observations associated with the month of December 2017. See ***Figure A.0.1: Florida Statewide Average Census by Month***. The inclusion of the calendar month as a hospital control value controlled for the variability. Days of the week were evaluated and not found to have meaningful coefficients with multiple days lacking statistical significance.

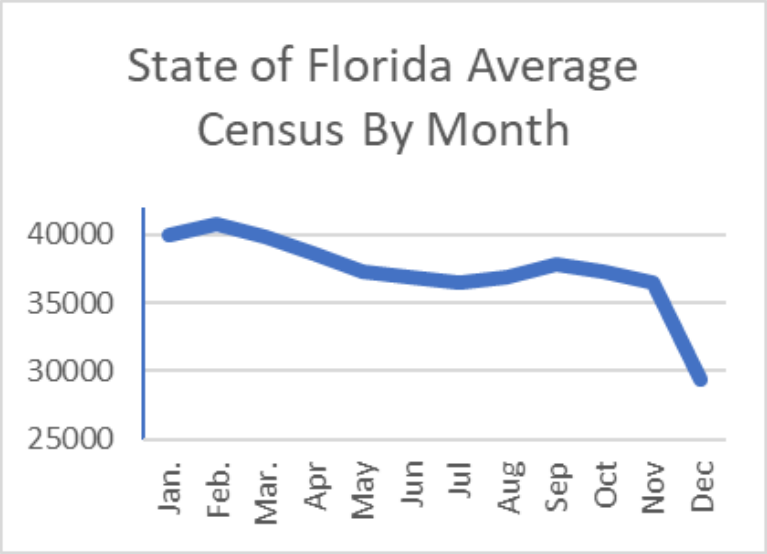


Figure A.0.1: Florida Statewide Average Census by Month

Although Bayesian Information Criterion (BIC) values are reported, all models were additionally evaluated using the Akaike Information Criterion (AIC). The BIC typically imposes a more stringent penalty for additional variables as the sample size increases. However, the substantial sample size of nearly 4 million resulted in minimal variation between AIC and BIC values (Vrieze, 2012). While the AIC utilizes a constant penalty multiplier of 2, the BIC penalty for this specific sample size (n =

4,051,587) is approximately 15.21. This difference is relatively negligible in this context because the large sample size drives the likelihood component to dominate both formulas.

$$\boldsymbol{AIC}_k = n\ln(SSE) - n\ln(n) + \mathbf{2}(k+1)$$

$$\boldsymbol{BIC}_k = n\ln(SSE) - n\ln(n) + (k+1)\,\mathbf{ln}(\boldsymbol{n})$$

APPENDIX 1.2: WALD CHI-SQUARED

Table A.1.0.1: Wald Chi-Squared for Full Model Dependent Variables

Variable	ChiSq	DF	p value
Age	132561	1	~0
Elixhauser	58012	1	~0
Payer	22762	6	~0
Total_Occupancy	19748	2	~0
AvgDRGpmt	16565	1	~0
Ownership	12184	2	~0
Sex	9591	1	~0
System Centralization	6212	5	~0
Bed Total	3635	1	~0
Teaching Hospital	765	1	~0
Race	657	2	~0
Month	546	11	~0
System Beds	431	1	~0
Ethnicity	401	1	~0
ACO	303	1	~0
Weekday	80	6	~0

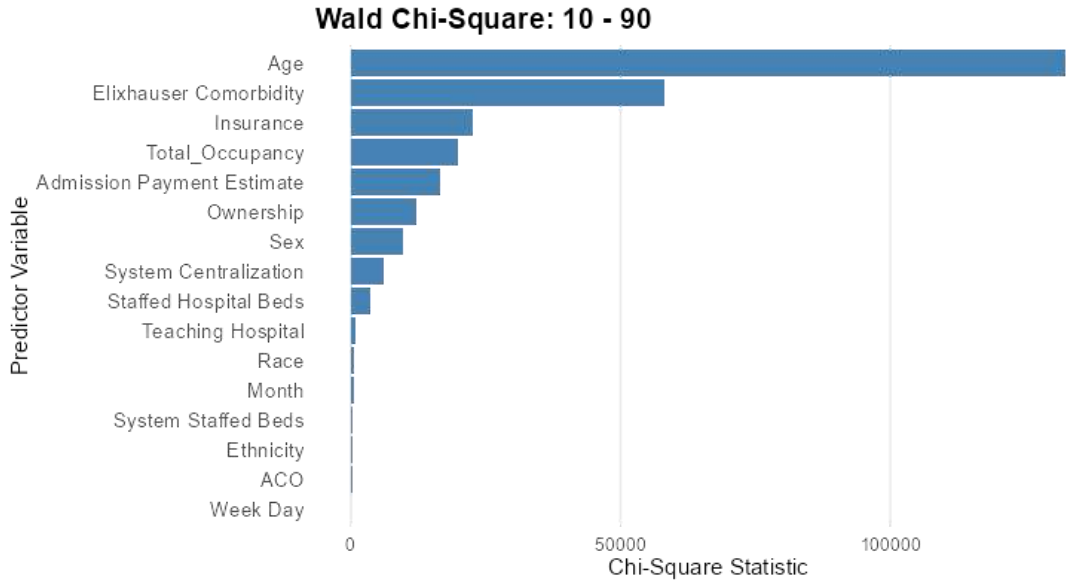


Figure A.1.2: Wald Chi-Squared Bar Chart

APPENDIX 1.3: ALTERNATIVE VARIABLE IMPORTANCE TABLE USING VARIABLE STANDARDIZATION

Variable	L2	Layer
Age	0.628	Patient
Insurance	0.616	External
Hospital Ownership	0.462	Hospital
System Centralization	0.449	System
Elixhauser Comorbidity Score	0.285	Patient
Sex	0.222	Patient
Rate of Occupancy	0.195	Hospital
Admission payment estimate	0.147	External
Race	0.118	Patient
Staffed Hospital Beds	0.109	Hospital
Month	0.104	Hospital
Teaching Hospital	0.073	Hospital
Ethnicity	0.065	Patient
Accountable Care Organization	0.049	Hospital
System Staffed Beds	0.039	Hospital
Weekday	0.027	Hospital

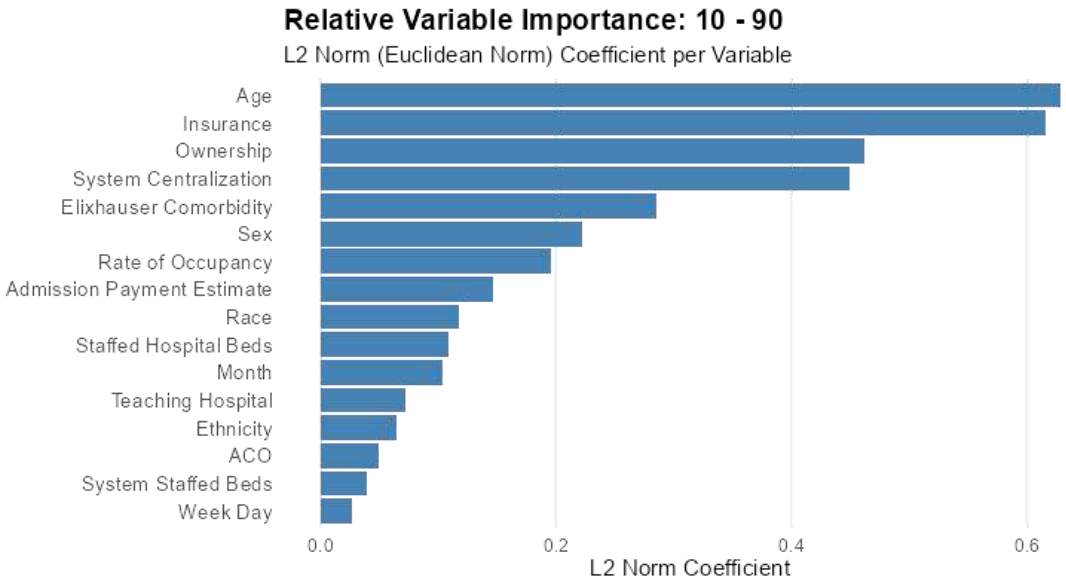


Figure A.0.2 BIC Variable Impact as Varied by Diagnostic Certainty Data

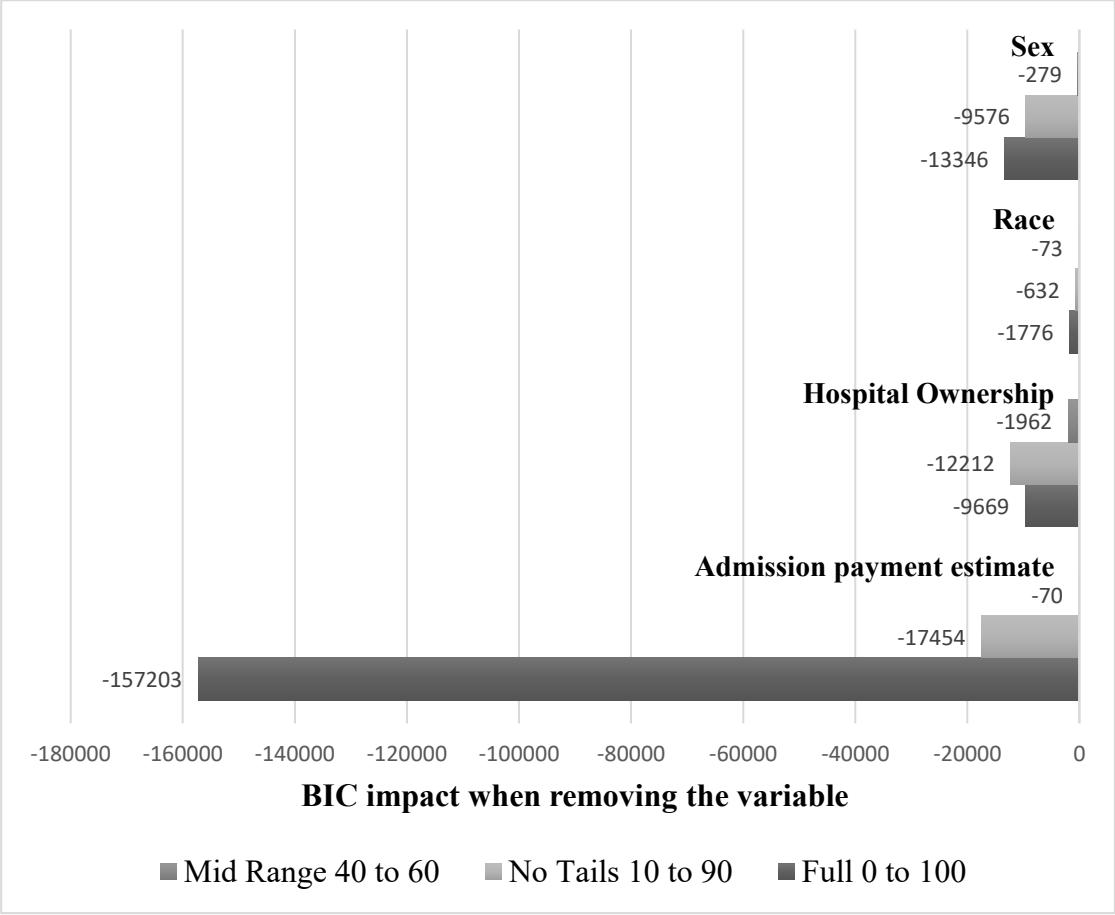


Figure A.0.3: Variable Influence on Admission Varies with Clinical Certainty

The difference between Medicare patients and the reference group of Commercial insurance is the most significant "payer effect" within the model. Managed Medicaid has a very low chi-squared compared to others, indicating that, for this specific population, there is little difference from Commercial insurance patients.

APPENDIX 1.4: MODEL COMPARISON ACROSS POPULATIONS WITH CLINICAL VARIABILITY

Diag. link to Admission %	10-90	40-60	0-100
		Narrowed Data	Expanded Data
Term	OR, Signif, SD	OR, Signif, SD	OR, Signif, SD
Patient			
Age (Years)	1.026*** (0.000)	1.018*** (0.000)	1.034*** (0.000)
Sex: (Ref: Male)			
Female	0.801*** (0.002)	0.924*** (0.005)	0.812*** (0.002)
Race (Ref: White)			
Black	0.990*** (0.003)	0.994 (0.007)	0.933*** (0.002)
Other	0.889*** (0.005)	0.950*** (0.012)	0.884*** (0.004)
Ethnicity (Ref: Non-Hispanic)			
Hispanic	0.937*** (0.003)	0.982* (0.008)	0.903*** (0.003)
Elixhauser Comorbidity Score	1.014*** (0.000)	1.012*** (0.000)	1.014*** (0.000)
Hospital Factors			
Teaching Hospital (Ref: No)			
Yes	1.075*** (0.003)	1.043*** (0.006)	1.078*** (0.002)
Hospital Ownership (Ref: Gov't)			
Nonprofit	1.051*** (0.003)	1.092*** (0.008)	1.041*** (0.003)
For-Profit	1.584*** (0.005)	1.584*** (0.012)	1.389*** (0.004)
Accountable Care Organization (Ref: No)			
Yes	1.051*** (0.003)	0.970*** (0.007)	1.059*** (0.002)
Staffed Hospital Beds (/100)	1.016*** (0.000)	1.017*** (0.001)	1.031*** (0.000)
Rate of Occupancy^{t} (Percent 0-100)	1.007*** (0.000)	1.007*** (0.000)	1.009*** (0.000)
Rate of Occupancy^{2}	1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)
Hospital System			
System Centralization (Ref: Undetermined)			
Centralized	0.744*** (0.005)	0.892*** (0.011)	0.805*** (0.004)
Centralized Physician	0.733*** (0.011)	0.718*** (0.026)	0.793*** (0.009)
Mod. Central	1.070*** (0.004)	1.115*** (0.010)	1.124*** (0.003)
Decentralized	0.896*** (0.004)	0.996 (0.010)	0.949*** (0.003)
Independent	0.967 (0.032)	1.431*** (0.077)	0.902*** (0.026)
System Staffed Beds (/1000)	0.989*** (0.001)	0.975*** (0.001)	0.994*** (0.000)
US Healthcare (External)			
Insurance (Ref: Commercial)			
Medicaid	1.277*** (0.006)	1.170*** (0.015)	1.303*** (0.005)
Managed Medicaid	1.011** (0.004)	0.930*** (0.010)	0.966*** (0.003)
Medicare	1.489*** (0.004)	1.369*** (0.009)	1.512*** (0.003)
Medicare Advantage	1.252*** (0.004)	1.123*** (0.010)	1.295*** (0.003)
Other	1.247*** (0.005)	1.185*** (0.013)	1.032*** (0.004)
Self	0.779*** (0.004)	0.809*** (0.011)	0.724*** (0.003)
Admission payment estimate (/$1000)^{tt}	1.051*** (0.000)	0.999 (0.001)	1.118*** (0.000)
Constant	0.074*** (0.008)	0.266*** (0.019)	0.012*** (0.006)
Weekday	Fixed	Fixed	Fixed
Month	Fixed	Fixed	Fixed
BIC	4674459	790423	8247635
N	4051587	605393	10659633

Statistical Significance * p<0.05, **p<0.01, ***p<0.001

To consistently evaluate the ability of an ED patient to be admitted, the data were filtered to include only adult, full-service hospitals, limited to the 152 hospitals that provided inpatient services linked to both diabetes and orthopedic surgery by DRG. An additional 6% of the observations were removed, leaving 10,002,576. All findings remained consistent.

APPENDIX 1.5: MODEL DIAGNOSTICS AND RESIDUAL ANALYSIS

The following diagnostic plots confirm that the model assumptions are satisfied and that the results are robust. The validity of the model was assessed through the analysis of randomized quantile (Dunn-Smyth) residuals, which should ideally follow a standard normal distribution if the model is correctly specified.

Histogram of Randomized Quantile Residuals: The distribution of residuals exhibits a symmetric, bell-shaped curve centered at zero. This indicates that the model is unbiased and that the error terms are normally distributed.

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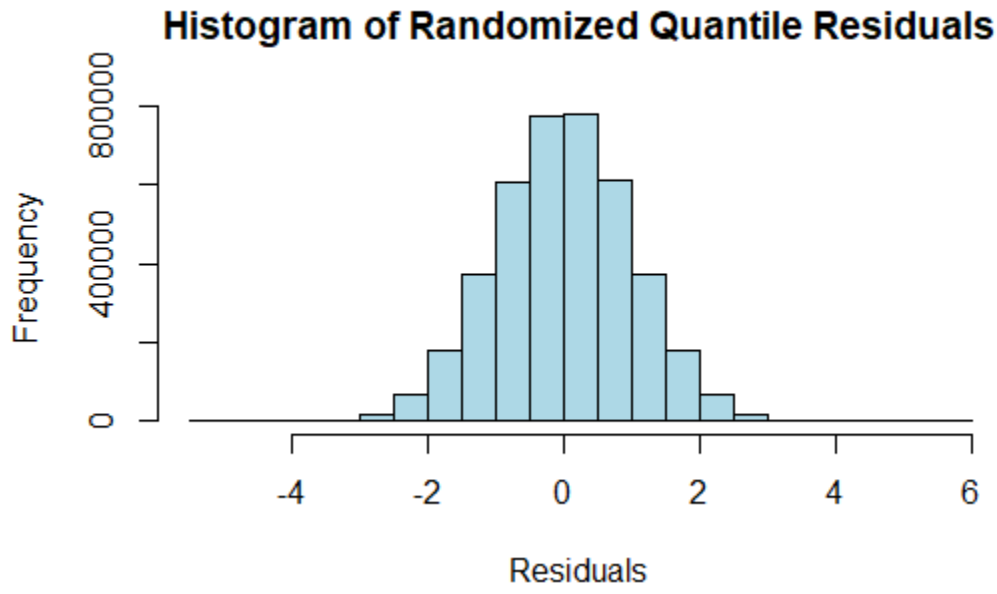


Figure A.0.4: Histogram of Randomized Quantile Residuals

Normal Q-Q Plot: The sample quantiles align almost perfectly with the theoretical normal quantiles along the 45-degree reference line. This strong linear relationship provides empirical evidence that the quantile residuals follow a normal distribution, which validates the chosen link function and error structure.

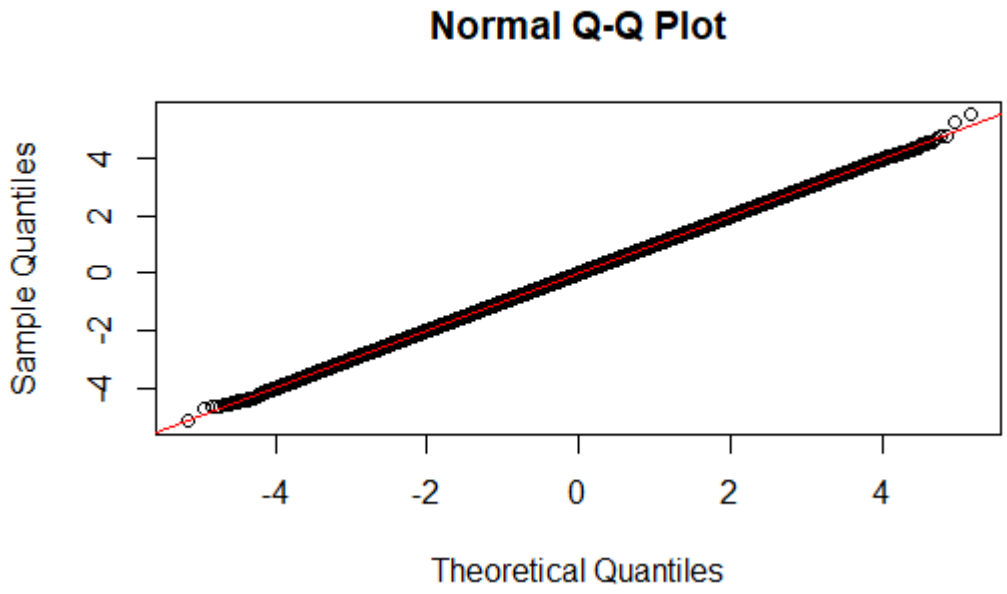


Figure A.0.5: Normal Q-Q Plot

Residuals vs. Fitted Values: The scatter plot demonstrates a dense distribution of residuals around the horizontal zero line. In general, the absence of distinct patterns suggests that the model maintains homoscedasticity and that there are no significant systematic errors in the predictions. A tighter spread of residuals is observable as fitted values approach the 1.0 boundary. This pattern is characteristic of a binomial model, as variance is naturally lower near probability boundaries. These fitted values are influenced by complex model specifications, including the quadratic term for occupancy squared. Furthermore, demographic factors influence the distribution of these predictions; for instance, younger patients are generally less likely to be admitted, which shifts their predicted probabilities toward the lower boundary.

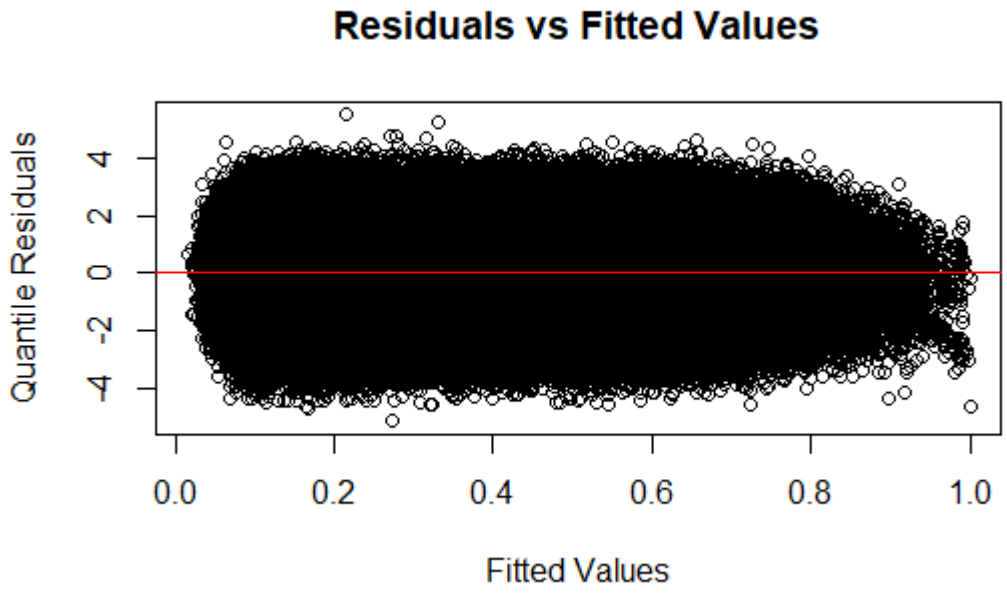


Figure A.0.6: Residuals vs. Fitted Values

Methods Details

The AHCA data includes values of 137 to denote missing fields, and the supercentenarian age of 110 was used as a cutoff to eliminate likely data entry errors. To preserve the observations for study, the ages values were replaced with the mean age of 41.30. Two observations were eliminated due to missing sex and ethnicity values.

APPENDIX 1.6: VARIABLE INFLATION FACTOR

While VIF values exceeding 10 generally warrant significant concern, even a conservative threshold of 4 suggests the need for further investigation (Pardoe et al., 2018). As illustrated in Table 5: Variance Inflation Factor, the final model contains no VIF values above 5, which confirms the statistical reliability of the included predictors.

Table A.1.0.2: Variance Inflation Factor

	VIF
AGE	2.255674
SEX Female	1.024747
RACE Black	1.148918
RACE Other	1.15096
ETHNICITY Hisp	1.242482
Elixihauser C	1.076846
WEEKDAY1	1.857372
WEEKDAY2	1.84168
WEEKDAY3	1.832298
WEEKDAY4	1.817098
WEEKDAY5	1.805895
WEEKDAY6	1.737536
Month Feb	1.755945
Month Mar	1.817665
Month Apr	1.777029
Month May	1.790773
Month Jun	1.74848
Month Jul	1.770901
Month Aug	1.77631
Month Sep	1.752111
Month Oct	1.775068
Month Nov	1.771835
Month Dec	1.780553
Teaching Yes	1.381493
Owner For Profit	2.376853
Owner Nonprofit	4.411042
ACO Yes	1.49749
Bed Total	2.456933
Pct Occ_c	1.677789
Pct Occ_c2	1.240743
System Central	1.569562
System Cent Phys	1.107436
System Mod	1.566597
System Decent	3.548619
System Indep	1.027693
System Beds	2.95982
PAYER MCAID	1.15348
PAYER MCAIDmng	1.598798
PAYER MCARE	2.18281
PAYER MCAREmng	1.848132
PAYER OTH	1.192911
PAYER SELF	1.390136
Avg DRG pmt	1.019928

There is a notable overlap between for-profit ownership and decentralized decision-making. See ***Figure A.0.7: Relationship Matrix of Ownership Type and***

System Centralization. VIF values were 4.4 and 3.5, yet both variable categories were retained in the analysis due to contextual importance.

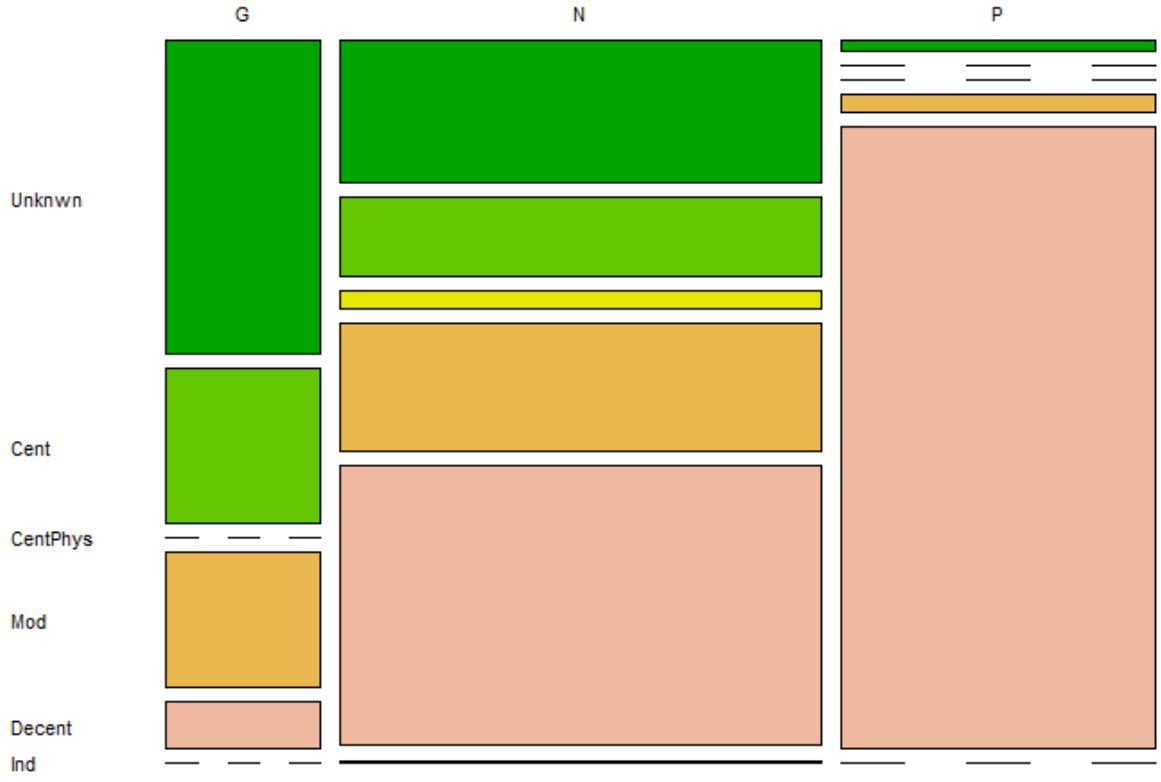


Figure A.0.7: Relationship Matrix of Ownership Type and System Centralization

APPENDICES FOR ARTICLE 2: BEYOND OUTCOMES: INCORPORATING ORGANIZATIONAL COMPLEXITY INTO VALUE-BASED PURCHASING DESIGN

APPENDIX 0.1: SEARCH STRATEGY

The PubMed platform was used from September 23, 2023, to October 19, 2025, to search the MEDLINE database for peer-reviewed articles. Since the concept of compensation tied to desired outcomes predates the Center for Medicare and Medicaid Services' official Hospital Value-Based Payment programs, no date range limits were specified for the search.

PubMed Query

("value based purchasing"[MeSH Terms] OR "reimbursement, incentive"[MeSH Terms] OR
"patient centered care/economics"[MeSH Terms] OR
("financial*"[All Fields] AND "incentiv*"[All Fields]) OR
("pay"[All Fields] AND "performance*"[All Fields]) OR
(("value"[All Fields] OR "values"[All Fields]) AND "purchas*"[All Fields]))

AND "hospitals"[MeSH Terms]

AND ((("health care quality, access, and evaluation"[MeSH Terms] OR
"quality indicators, health care"[MeSH Terms] OR
"Mortality"[MeSH Terms] OR
"Mortality"[MeSH Subheading] OR
("qualities"[All Fields] OR "quality"[All Fields] OR "quality s"[All Fields]) OR
(("ambulatory care facilities"[MeSH Terms] OR
("ambulatory"[All Fields] AND "care"[All Fields] AND "facilities"[All Fields]) OR
"ambulatory care facilities"[All Fields]

OR "clinic"[All Fields]
OR "clinic s"[All Fields]
OR "clinical"[All Fields]
OR "clinically"[All Fields]
OR "clinicals"[All Fields] OR
"clinics"[All Fields])

AND "performance*"[All Fields]))

AND ("Hospital Administration"[MeSH Terms] OR

"Organization and Administration"[MeSH Terms] OR

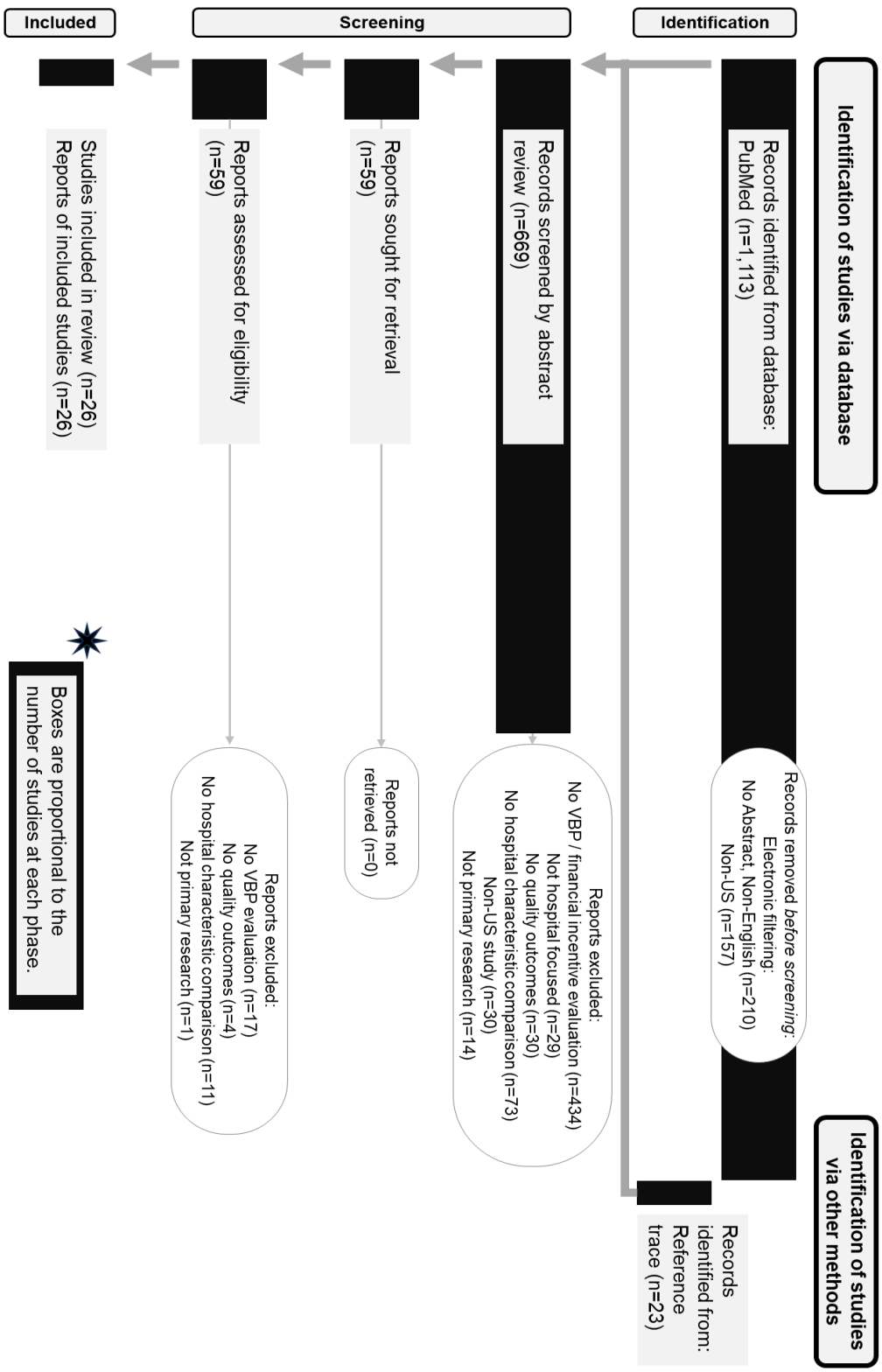
"Organizational Culture"[MeSH Terms] OR

"Health Facility Merger"[MeSH Terms])) OR

"Health Facility Size"[MeSH Terms] OR

"Organization and Administration"[MeSH Subheading])

APPENDIX 0.2: PRISMA FLOW DIAGRAM



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71, http://www.prisma-statement.org/

10/19/2025

After the initial search results were identified, each abstract was reviewed to eliminate any studies that did not meet the specified criteria. The full texts of all remaining articles were scrutinized to ensure consistency with the literature review criteria. Throughout the iterative search and reference-chasing process, 23 additional articles were identified for consideration. A disproportionate number of studies (18 out of 26) included in the final review were selected via reference tracing.

Appendix 0.3: Characteristic Findings by Article

#	*Article Title*	*First Author*	*Journal*	*Publication Year*
1	Association between degree of exposure to the Hospital Value Based Purchasing Program and 30-day mortality: experience from the first four years of Medicare's pay-for-performance program	Banerjee S	BMC Health Serv Res	2019
2	Association between value-based purchasing score and hospital characteristics	Borah BJ	BMC Health Serv Res	2012
3	Association of Magnet Nursing Status With Hospital Performance on Nationwide Quality Metrics	Boylan MR	J Healthc Qual 1.3	2019
4	Complication Rates, Hospital Size, and Bias in the CMS Hospital-Acquired Condition Reduction Program	Koenig L	Am J Med Qual 1.4	2017
5	Do Magnet®-Designated Hospitals Perform Better on Medicare's Value-Based Purchasing Program?	Spaulding A	J Nurs Adm	2020
6	Does hospital ownership influence hospital referral region health rankings in the United States	Hamadi H	Int J Health Plann Manage	2018
7	Hospital characteristics associated with success in a pay-for-performance program in orthopaedic	Bhattacharyya T	J Bone Joint Surg Am	2008
8	Hospital Performance in the First 6 Years of Medicare's Value-Based Purchasing Program	Carroll NW	Med Care Res Rev	2021
9	Hospital Value-Based Purchasing Performance: Do Organizational and Market Characteristics	Spaulding A	J Healthc Manag 1.8	2018
10	Overall ED efficiency is associated with decreased time to percutaneous coronary intervention for ST-segment elevation myocardial infarction.	Jones CW	The American journal of emergency medicine	2014
11	Relationship between organizational factors and performance among pay-for-performance hospitals	Vina ER	J Gen Intern Med 5.7	2009
12	The Association of Hospital Magnet(®) Status and Pay-for-Performance Penalties	Dierkes AM	Policy Polit Nurs Pract	2021
13	The early experience of a hospital-based pay-for-performance program	Sautter KM	J Healthc Manag	2007
14	The relationship between hospital patient safety culture and performance on Centers for Medicare & Medicaid Services value-based purchasing metrics	Noghrehchi P	Health Care Manage Rev	2024
15	The role of community-level characteristics in comparing United States hospital performance by magnet designation: A propensity score matched study	Menser T	J Adv Nurs	2023
16	US National Trends in Mortality From Acute Myocardial Infarction and Heart Failure: Policy Success or Failure?	Chatterjee P	JAMA cardiology	2018
17	Value-based purchasing and hospital acquired conditions: are we seeing improvement?	Spaulding A	Health Policy 3.3	2014
18	Value-based purchasing, efficiency, and hospital performance	Zhao M	Health Care Manag (Frederick)	2015
19	When Agency Fails: An Analysis of the Association Between Hospital Agency Staffing and Quality Outcomes	Beauvais B	Risk Manag Healthc Policy	2024
20	Why Did New York State Hospitals Rank So Poorly?	McLaughlin CC	Med Care	2023

	Size		Ownership				Clinical				Operational				Population					Geographic					Payment			
#	*Size = Large*	*Size = Small*	*Ownership For-Profit*	*Ownership Non-Profit*	*Ownership Government*	*System Integrated*	*Teaching Hospital*	*Nursing Magnet®*	*Staffing Levels*	*Clinical Specialization*	*Infrastructure Support*	*ACO participation*	*Cultural Support*	*Efficiency*	*Race / Ethnicity*	*Education Levels*	*Poverty*	*Population Density*	*Case Mix Index*	*Geographic Region*	*Rural*	*Urban*	*Safety Net*	*Competition*	*Medicare*	*Medicaid*	*Fewer Measures*	*Incentive Characteristics*
1	**m**	**m**	**m**		**n**		**p**							**p**			**n**			**n**								
2	**n**	**p**	**p**		**n**		**n**		**p**										**n**	**p**						**n**	**p**	
3								**m**																				
4	**m**	**p**																										
5								**m**																				
6	**m**		**n**	**p**	**n**												**n**	**m**							**m**	**n**		
7							**p**			**p**				**p**					**p**	**p**								
8	**n**			**p**	**p**			**p**				**p**					**n**	**n**	**n**			**n**	**n**					
9	**p**	**n**			**p**	**p**	**p**										**p**	**p**						**n**	**p**			
10														**p**														
11											**p**		**p**													**n**		
12								**p**																				
13							**m**				**p**																	**m**
14				**p**																								
15								**p**																				
16	**p**	**n**	**n**	**p**	**n**	**p**	**p**				**p**									**m**	**n**					**n**		
17	**n**		**n**		**n**		**n**													**m**	**n**				**p**	**n**		
18	**p**		**p**	**p**		**p**	**p**																			**n**		
19	**p**		**p**		**n**									**p**					**m**	**n**	**p**			**n**	**m**	**n**		
20			**n**		**p**										**m**	**p**	**n**											

APPENDIX 0.4: LITERATURE REVIEWED DETAILS FOR ANALYSIS

Citation	Title	Study Design	Data Source	Quality Payment Model	Quality Outcome Measures	Hospital Characteristics	Pos Neg Mix	Study Notes / Limitations
Banergee et al., 2019	Association between degree of exposure to the Hospital Value Based Purchasing Program and 30-day mortality: experience from the first four years of Medicare's pay-for-performance program	Quantitative	CMS Hospital Compare 2009-2016, Census Bureau American Community Survey 2017, AHA 2016	HVBP	Mortality	Teaching Hospital Government Run Beds 100-199 Beds >200 South Region West Region Patient Census Poverty	p n n m n n p n	Study suggest limited impact of HVBP towards improving mortality when comparing hospitals that have greater than 55% of their patient population as Medicare vs under 55%. Unstated assumption that non-Medicare patients are not included in value based payment models. Number of hospitals in the study was limited to 1902.
Beauvais et al., 2024	When Agency Fails: An Analysis of the Association Between Hospital Agency Staffing and Quality Outcomes	Quantitative	2021-2022 Definitive Healthcare, AHA, HCRIS, HVBP, HC	HVBP	Readmission, Clinical Domain	Agency Labor Cost Discharges LOS Staffed Beds Rural Bed Utilitization Competition Government Run For Profit Medicaid Medicare Case Mix Index Region Complications comorbidity	n p p p p p n n p n m m n p	Fourth party data collection, n=2295, agency labor cost was not significant with readmissions but was with HVBP clinical care domain
Bhattacharyya et al., 2008	Hospital characteristics associated with success in a pay-for-performance program in orthopaedic surgery	Quantitative	CMS/HQID Project, AHA directory	CMS/HQID Project	Hip and Knee Replacement	Procedure Volume Case Mix Index Region Midwest Teaching Hospital Total Volume	p p p p p	Limited number of hospitals included (215). Orthopedic procedure related clinical performance was used to identify the top 20% and compare characteristics against the remaining hospitals. Potential multicollinearity and limited description of statistical analysis.
Borah et al., 2012	Association between value-based purchasing score and hospital characteristics	Quantitative	2013 Medicare HC, 2010 AHA Annual Survey, 2009 Medicare Impact File	Medicare VBP Program	Clinical Process of Care	Case Mix Index Beds 400-499 Beds 6-99 Clinical Process For Profit Geographic Region Medicaid Nurse Staffing Teaching Hospital Total Number of Measures	n n p p p p n p n n	VBP scores were used to create four quartiles and characteristics were compared between the quartiles. Only 2491 hospitals included. Assumes financial incentives do not change short term results. Multiple data tables included.
Boylan et al. 2019	Association of Magnet Nursing Status With Hospital Performance on Nationwide Quality Metrics	Quantitative	2013-2015 HACRP, 2013-2015 VBP, 2012-2015 RRP, ANCC	HACRP, VBP, RRP	Likeliness of penalty	Magnet status	m	Matched cohort of Magnet hospitals to compare likeliness of penalization. 3190 hospitals. Matching was limited to 4 variables. Analysis was limited and the discussion focused on reasons why the results might be wrong
Carroll & Clement, 2021	Hospital Performance in the First 6 Years of Medicare's Value-Based Purchasing Program	Quantitative	2013-2018 CMS HC, AHA annual survey, CMS impact file, Medicare Cost Reports, AHRF, ANCC	VBP	Grouping of VBP performance	Safety Net Non-Profit Government Run Bed Size Case Mix Index Urban Population size Poverty ACO participation Magnet status	n p p n n n n n p p	Comparison of VBP performance groups of poor, good, improvers, decliners, and mixed performance. 2429 hospitals. Performance criteria changed during the evaluation period. The study included organizational and community characteristics to evaluate conditions towards the ability to improve. Discussion included the concern that financial incentives might not be strong enough and VBP performance may be outside the control of management influence.
Chatterjee & Joynt Maddox 2018	US National Trends in Mortality From Acute Myocardial Infarction and Heart Failure: Policy Success or Failure?	Quantitative	2009-2015 CMS Hospital Compare, AHA Annual Survey	HVBP	30-day mortality rates, AMI, HF	Small hospital Large hospital Government Run Non-Profit For Profit Teaching Hospital System Affiliated Infrastructure	n p n p n p p p	Cross-sectional study comparing low performance hospitals against all others. Bivariate regression, logistical regression. Additional variables included rural designation, Region, and Prop. of Medicaid. 3796 hospitals.

Citation	Title	Study Design	Data Source	Quality Payment Model	Quality Outcome Measures	Hospital Characteristics	Pos Neg Mix	Study Notes / Limitations
Dierkes et al., 2021	The Association of Hospital Magnet(®) Status and Pay-for-Performance Penalties	Quantitative	2015-2017 AHA, National P4P Map, Final Rule Impact File, AANC	VBP, HRRP, HACRP	Penalty avoidance	Magnet status	p	Matched pair comparison of Magnet hospitals to non-Magnet hospitals. 2860 hospitals. Matched analysis required further adjust for characteristics.
Haley et al., 2016	The Influence of Hospital Market Competition on Patient Mortality and Total Performance Score	Quantitative	2013-2014 AHA annual survey, 2014 HC Readmissions, 2014 AHRF	VBP	Mortality Rates	Competition Non-Profit Beds >500 System Affiliated Teaching Hospital Urban Income Medicare Medicaid For Profit	p p p p p p p p m p	Studies hospital competition and the impact on mortality but assumes that patient volumes are exclusive to the county of the hospital location. 3261 hospitals. The study noted no two variables were highly collated (not consistent with other research).
Hamadi et al., 2018	Does hospital ownership influence hospital referral region health rankings in the United States	Quantitative	2016 Commonwealth Fund Scorecard on Local health System Performance, 2016 AHA annual survey, 2016 HVBP	HVBP program	Avoidable Hospital Use and Cost, Prevention and Treatment, Healthy Lives	Staffed Beds For Profit Non-Profit Government Run Medicare Medicaid Per Capita Income Population size	p n p n m n p m	Hospitals were lumped into 301 hospital referral regions (HRR) for comparison. Limited discussion on the data analysis techniques as some variables lost significance when performing bivariate versus multivariate analysis (including Non-Profit status).
Hoehn et al., 2016	Hospital resources are associated with value-based surgical performance	Quantitative	University HealthSystems Consortium Clinical Database 2009 2013, AHA Annual Survey 2013	HVBP,HRRP	Surgical Mortality Rates	Teaching Hospital Catholic Admissions / bed LOS Medicare Medicaid Surgical volume Staffing / bed Physicians / bed Hospitalists / bed Rad tech / bed Lab tech / bed Capital expenditure / bed	p p p n p n p p p p p p p	High value hospitals were based on top quartile performance in surgical mortality and cost. Low n of 45 in each comparison group. Conclusion include concern of directionality in the correlations and the potential impact on value based payments.
Jones CW et al, 2014	Overall ED efficiency is associated with decreased time to percutaneous coronary intervention for ST-segment elevation myocardial infarction.	Quantitative	2011 CMS Hospital Compare	HVBP	STEMI Door-to-Balloon time	ED efficiency	p	Linear regression with Door-to-Balloon time as the dependent variable. Data at the hospital level prevented the models from including patient related variables. Control variables included teaching status, size, region, and rural/urban. Efficiency variables on significance included ED LOS, ED LOS for admitted pts, LBT, and time to triage. 1557 hospitals.
Koenig et al., 2017	Complication Rates, Hospital Size, and Bias in the CMS Hospital-Acquired Condition Reduction Program	Quantitative	2009-2011 Medicare Fee-for-Service inpatient claims, 2015 CMS Inpatient Prospective	HACRP	Rates of	Size = Large Size = Small	m p	Simulation analysis of the likeliness of bottom quartile performance in the rates of hospital complications. 3458 hospitals. Simulation assumptions could have impacted the results.
Lasater et al., 2016	Hospitals Known for Nursing Excellence Perform Better on Value Based Purchasing Measures	Quantitative	2015 VBP HC, ANCC Magnet database, 2014 AHA annual survey	VBP	TPS, Process of Care,	Magnet status	p	323 Magnet hospitals match to 253 hospitals for comparison. 10 characteristic factors used for matching. Analysis includes reference to characteristic association with the pursuit of Magnet status, but does not include that significant cash reserves would be included in that characteristic in order to pay for the Magnet preparation and application.
McLaughlin, 2023	Why Did New York State Hospitals Rank So Poorly?	Quantitative	Hospital Compare Care, AMA 2019, 2019 CMS Hospital Service Area File, American Community Survey 2015-2019, 2017-2019 Healthcare	HVBP	Excess Days in	For Profit Government Run Race Education Poverty	n p m p n	Advanced statistical analysis risk adjusted for variables shows impact on patient satisfaction and excessive days in acute care. Excessive days is used as an alternative to readmission rates. There is correlation noted without consideration of relationship.

Citation	Title	Study Design	Data Source	Quality Payment Model	Quality Outcome Measures	Hospital Characteristics	Pos Neg Mix	Study Notes / Limitations
Menser et al., 2023	The role of community-level characteristics in comparing United States hospital performance by magnet designation: A propensity score matched study	Quantitative	2021 HVBP, 2019 AHA annual survey, 2020 CHR database, 2019 ANCC Magnet Recognition, 2019 AHRF	HVBP	HVBP Domains	Magnet status	p	Magnet matched pair for odds of better HVBP domains. No description for cleaning data. 401 out of 1567 hospital were matched to the 401 magnet hospitals based on nearest neighbor.
Noghrehchi et al., 2024	The relationship between hospital patient safety culture and performance on Centers for Medicare & Medicaid Services value-based purchasing metrics	Quantitative	2018, 2021 AHA, AHRQ, HSOPS	HVBP	Clinical Care Domain	Patient Safety Grade Patient Safety Perception Non-Profit	m m p	n=122, regression model, no significance for clinical care domain
Sautter et al., 2007	The early experience of a hospital-based pay-for-performance program	Qualitative	2002-2004 Blue Cross Blue Shield Michigan P4P, 2005 site visits	Blue Cross Blue Shield Michigan P4P	LVEF left	Incentive Size Infrastructure Teaching Hospital	m p m	Group interviews. 86 hospitals. 10 hospital site visits / interviews. BCBS Michigan. Documentation improvement was a key finding and supported by infrastructure.
Spaulding et al., 2014	Value-based purchasing and hospital acquired conditions: are we seeing improvement?	Quantitative	2012-2013 AHA annual survey, 2012-2013 HACRP Database, 2013 Final Rule Standardizing File, 2013 HVBP Database	VBP	Rate of Hospital Acquired Conditions	For Profit Medicare Medicaid Rural Region Government Run Teaching Hospital Beds >200	n p m n m n n n	Regression analysis for VBP performance against hospital acquired conditions. 2927 hospitals.
Spaulding et al., 2018	Hospital Value-Based Purchasing Performance: Do Organizational and Market Characteristics Matter?	Quantitative	2013-2014 AHA annual survey, 2014 AHRF, 2014 HVBP, Medicare HC	HVBP program	Mortality Rates, Process of Care	System Affiliated Large hospital Government Run Teaching Hospital Large Population Income Medicare Competition	p p p p p p p n	Compares hospital characteristics in multivariate analysis by total performance, process of care, patient experience, and outcome. 1831 hospitals.
Spaulding et al., 2020	Do Magnet®-Designated Hospitals Perform Better on Medicare's Value-Based Purchasing Program?	Quantitative	2017 HVBP database, 2015 AHRF, 2014-2017 AHA annual survey, 2014-2017 Medicare Final Rule Standardizing File, 2014-2017 HCRIS, ANCC	HVBP program	TPS, Process of care domain	Magnet status	m	Comparison of Magnet hospitals against the remaining hospitals. 2686 hospitals. Conclusion assumes causality.
Vina et al., 2009	Relationship between organizational factors and performance among pay-	Mixed Methods	Telephone Survey, 2004-2005 HQID	HQID	Overall Composite Quality Score	Medicaid Infrastructure Culture	n p p	Telephone survey, compared top and bottom performing organizations. 84 hospitals.
Williams et al., 2007	Is the Quality of Hospital Care a Function of Leadership?	Quantitative	2000 AHA annual survey, 1998-2000 TJC	n/a	TJC quality measures	Efficiency	p	Limited use of hospital characteristics compared to TJC quality reporting. 143 hospitals.
Zhao et al., 2015	Value-based purchasing, efficiency, and hospital performance	Quantitative	2013 AHA annual survey, 2013 Medicare HC database	HVBP	Weighted Clinical Process of Care	Large hospital Teaching Hospital System Affiliated For Profit Medicaid Non-Profit	p p p p n p	Bivariate analysis of clinical process, patient satisfaction and TPS against hospital characteristics, Clinical Process and Patient Satisfaction results are not aligned. 2849 hospitals.

Abbreviations:
Agency for Healthcare Research and Quality (AHRQ)
American Hospital Association (AHA) annual survey
American Nurses Credentialing Center (ANCC)
Area Health Resources Files (AHRF)
Community Health Ranking (CHR)
Healthcare Cost and Utilization Project (HCUP)
Healthcare Cost Report Information System (HCRIS)
Hospital Acquired Conditional Reduction Program (HACRP)
Hospital Readmissions Reductions Program (RRP) or (HRRP)
Hospital Survey on Patient Safety (HSOPS)
Hospital Value Based Purchasing (VBP) or (HVBP)
Joint Commission on Accreditation of Healthcare Organizations (TJC)
Medicare Hospital Compare (HC) database
Premier Hospital Quality Incentive Demonstration (HQID)

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A.A. in Liberal Arts, May 1996.

Emory Dean's Scholar: full tuition scholarship

President of Mu Epsilon Delta: Pre-Medical Honor Society

Independent Study: Tropical Cyclone Disruption (Weather Modification)

PROFESSIONAL EXPERIENCE

SUMMARY SKILLS

Leadership Development, Strategy Analytics, Finance Management, Education, Physician Relationships, Revenue Enhancement, Conflict Resolution

ST. LUKE'S PHYSICIAN GROUP (SLPG), ALLENTOWN, PA 2016 – 2020

Senior Director, West Division 2018 – 2020

Executive and operational leadership for all primary care practices supporting St. Luke University Health Network hospitals of Allentown, Sacred Heart Hospital in Allentown, Miners, Lehighton, Carbon, and Geisinger St. Luke's Hospital in Orwigsburg

Responsible for three divisions, 34 primary care practices, 105 providers, $29 million annual net revenue, and 1,400 square miles of territory

Regional Director, Allentown 2016 – 2018

Responsible for primary care operations in 12 practices with 42 providers.

LEHIGH VALLEY HEALTH NETWORK (LVHN), ALLENTOWN, PA

2010 – 2016

Program Manager, Hospital Consumer Assessment of Healthcare Providers and Systems, (HCAHPS) / Patient Experience 2013 – 2016

Implemented best practices for patient experience and reported HCAHPS data across seven campuses. Directly reported to the System Chief Nursing Officer. Supported: Patient Centered Experience, Network Process Improvement, Leadership Operations, and multiple nursing councils.

Interim Service Line Director 2013 – 2013

Led the Weight Management Center operations for pre-surgical weight loss, medical management, and tobacco cessation.

Practice Director 2010 – 2013

Provided operations oversight for the Infectious Disease practice with 18 providers

OXYGEN PLUS, VERO BEACH, FL 2008 – 2010

(Family-owned Durable Medical Equipment Company)

Finance and Transition Administrator

Implemented an integrated billing, purchasing, inventory, and EMR software. Negotiated sale and business transfer agent.

HEALTH MANAGEMENT ASSOCIATES, NAPLES, FL 2004 – 2008

(62 hospital system. Acquired by Community Health System and subsequently divested. Hospitals are identified by the current name.)

Chief Operating Officer, (UPMC Lititz), Lititz, PA 2005 – 2008

Operations and executive leadership for a 144-bed teaching hospital

Interim Chief Executive Officer

Assistant Administrator, (AdventHealth Heart of Florida), Haines City, FL

2004 – 2005

Managed the Laboratory, Housekeeping, Dietary, Medical Staff Office, and Telephone Services of a 142-bed hospital with a Net Revenue of $175 million

COOK CHILDREN'S HEALTH CARE SYSTEM, FORT WORTH, TX

2003 – 2004

Administrative Resident

Children's integrated health system, including a 282-bed Hospital, Health Plan, Physician Network, and Home Health company with combined Net Revenues of $800 million

OXYGEN PLUS, VERO BEACH, FL 1999 – 2003

(Family-owned Durable Medical Equipment Company)

Owner

Start up a Durable Medical Equipment company with annual net revenue of $750 thousand. Performed, managed, and transitioned all business functions.

ADDITIONAL EXPERIENCES

Hospital Volunteer – Emergency Department, Surgical Operations, Medical & Surgical inpatient floors, and Radiology

Hospital Transporter – Critical Care

Ocean Rescue Lifeguard / Emergency Medical Technician (EMT)

Hospital Ambulance Transport Driver

Emergency Medical Services Volunteer - EMT

TEACHING EXPERIENCE

FACULTY SPONSOR

Computer Science Capstone: HealthCost Unlocked, Spring 2025, Fall 2025, Spring 2026, Fall 2026

Lehigh University, P.C. Rossin College of Engineering and Applied Science

Student Developed Executive Summary: A web application designed to empower healthcare consumers by translating complex medical bills into clear, plain language. Users will be able to upload medical documents (bills and Explanation of Benefits) to receive comprehensible summaries, cost breakdowns, and alerts for potential billing errors. In doing so, the platform aims to enhance transparency and medical literacy, while also identifying and addressing issues such as invalid charges or duplicate billing, which will facilitate future research and the expansion of transparency.

INSTRUCTOR IN PRACTICE

Impact Fellowship: HealthCost Unlocked, CINQ 389, Spring 2025, Summer 2025, Fall 2025, Spring 2026, Fall 2026

Lehigh University, College of Arts and Sciences, Creative Inquiry

PRIMARY INSTRUCTOR OF RECORD

Truth and Realities of TV Medicine, POPH 150, Spring 2024

Special Topics Course Creation

Lehigh University, College of Health, Population Health

Course Description: This introductory course explores the truths and realities underlying the glamorized perspectives of TV medicine. Students will learn real-life concepts related to physicians and medical professionals in the provision of healthcare. Topics include working conditions, organizational structures, regulations, financial aspects, and contributory areas of medicine. Students will be able to identify television scenes and describe how they compare and contrast with real-life healthcare delivery.

RECITATION INSTRUCTOR

Seven Dimensions of Health and Wellness, CGH007, Fall 2023

Lehigh University, College of Health, Community and Global Health

TEACHING ASSISTANT

Seven Dimensions of Health and Wellness, CGH007, Fall 2023

Lehigh University, College of Health, Community and Global Health

Primary Instructor: Christine Daley

Introduction to Population Health, POPH001, Fall 2022

Lehigh University, College of Health, Population Health

Primary Instructor: Jong Shin

Population Health Research Methods & Application, POPH002, Spring 2023

College of Health, Lehigh University, Population Health

Primary Instructor: Fatima Wakeel

PUBLICATIONS

U.S. PATENT, Rovella, E. (1995, August 15). US5441200A - Tropical Cyclone Disruption. https://www.google.com/patents/US5441200A

VIRTUAL REALITY (VR), Bodzin, A., Araujo-Junior, R., Hammond, T., Pan, Z., Anastasio, D., Agarwal, U., Arnoat Perez, M., Bao, J., Burd, J., Chen, Y., Cicero, T., De Los Santos, J., Escobar, M., Faisal, R., Hu, X., Jhaveri, K., Koelsch, J., Le, Q., Marlatt, M., Nester, J., Righi, N., Rovella, E.J., Sary, L., Silverman, M., Zhu, J., Whitney, H., Wu, M., Schwartz, C., Mayer, D., Neitz, R. & Semmens, K. (2025). Mystery of the Lehigh Gap desktop VR version.

IN PRESS, Rovella, E., Too Big to Care: The Boundless Growth of Health Systems. Health Policy & Politics, 2(1).

PRESENTATIONS

CONFERENCE PRESENTER

"Operationalizing Transparency: AI-Driven Decision Support in Healthcare Billing" Invited Speaker: Recent Advancements in Healthcare Operations, Production and Operations Management Society (POMS), Annual Conference, May 2026, Reno, Nevada

"ED Admission Decisions linked to Financial and Organizational Variables" Production and Operations Management Society (POMS), Annual Conference, May 2026, Reno, Nevada

"Using AI in Teaching and Learning at Lehigh" 2nd Annual AI@Lehigh Summit, Lehigh University, January 13, 2026, Bethlehem, Pennsylvania

"AI-responsive teaching and learning" Lehigh University, Fall 2025 Teaching and Learning Symposium, November 2025, Bethlehem, Pennsylvania

“Are We Measuring Quality? A Qualitative Assessment of Pediatric Home Intensive Care Unit (HICU®)” American Public Health Association, APHA 2025 Annual Meeting and Expo, November 2025, Washington, D.C.

Research in the Rough, Dissertation Overview: “Value-Based Purchasing, Agency, Organizational Characteristics, and Quality Outcomes” College of Healthcare Operations Management (CHOM) Production and Operations Management Society (POMS), Annual Conference, May 2025, Atlanta, Georgia

“Non-Profit Hospital Growth and the Abandonment of Those Without Financial Resources” Interdisciplinary Association for Population Health Science (IAPHS) 2024 Conference, September 2024, St. Louis, Missouri

"Bridging perspectives and cultural gaps between students, educators, and the world after college" Lehigh University’s 2024 Symposium on Teaching and Learning Center for Innovation in Teaching and Learning (CITL), Faculty Presentations, April 2024, Bethlehem, Pennsylvania

POSTER PRESENTATIONS

“Financial influences on hospital admissions: Patient-level decision-making from the Emergency Department” American Public Health Association (APHA) APHA 2025 Annual Meeting and Expo, November 2025, Washington, D.C.

"The Advancement and Sustainability of Patient Centered Innovations with Pediatric Home Intensive Care Units (HICU®)" AcademyHealth, 2025 Annual Research Meeting, June 2025, Minneapolis, Minnesota

"Patient Satisfaction is No Longer Relevant to the Delivery of Healthcare (Financially)" Interdisciplinary Association for Population Health Science (IAPHS) 2024 Conference, September 2024, St. Louis, Missouri

VIDEO PRESENTATIONS

EJ Rovella, Goldner, M., Rush, J., & Migliori, G. (2014, October 24). Physician Communication Video 2014 LVHN. YouTube. https://www.youtube.com/watch?v=TO8NaO_1GWQ

RESEARCH EXPERIENCE

RESEARCH IN PROGRESS

"International Student Insights in Healthcare Financial Literacy"

"Health Billing Data Collection and Data Security"

RESEARCH ASSISTANT EXPERIENCE

Research Assistant for Professor Michael Gusmano. 2024 – 2026, Gene Therapy & BAYADA Home Health Care, Home Intensive Care Unit, HICU®:

Computer skills: AI prompt engineering, Gemini, Claude, ChatGPT, Llama, Programming experience and statistical applications. R, RStudio, Office Suite, Google applications, C++, Unity

SERVICE

Vice-President, Brodie Woodall Memorial Scholarships, Inc. 2024 – Present, Supporting academic advancement and mental health & wellness, www.brodiewoodall.com

Treasurer, Maplewood Estates HOA, Coopersburg, PA, 2020 – 2026

Pennsylvania Junior Academy of Science Judge, 2010 – 2025

Volunteer Soccer Coach, Southern Lehigh Soccer League, 2021 – 2025

Cub Scout volunteer – Pack 334, Coopersburg, PA, 2017 – 2020

Fellow of the American College of Health Executives, 2015 – 2017

Board Member, Leonard Pool Philanthropic Society, Lehigh Valley Health Network, 2005 – 2020

Financial administrator for the Luther V. Rhodes III Endowment in Infectious Diseases, 2011 – 2016

Board Member of the Mid-Atlantic American Lung Association, (PA, NJ, DE, WV), Legislative Committee, 2010 – 2012

Advisory Committee Member of the Lehigh Valley chapter of the American Lung Association (Mid-Atlantic), 2010 – 2012

Warwick High School Business Advisory Board Member, Lititz, PA, 2007 – 2008

Lancaster Chamber of Commerce, Manheim / Warwick Consortium, Health and Wellness Subcommittee, 2005 – 2008

Warwick Township Strategic Planning Committee, Community Services Subcommittee, Lititz, PA, 2006 – 2008

American Cancer Society – Relay for Life, Co-Chair and Master of Ceremonies, Greater Haines City, FL 2005

Chamber of Commerce - Vero Beach, FL & Haines City, FL 2004 – 2005

EXTRAMURAL FUNDING / AWARDS

Faculty Fellow, Spring 2026 & Fall 2025, Lehigh University, Center for Innovation in Teaching and Learning (CITL), This capstone project focuses on advancing a patient-friendly online platform designed to convert complex medical bills into accessible formats. The collaboration leverages generative AI as a pedagogical tool to evolve the platform's capabilities using Lehigh data resources.

Faculty Fellow, Spring 2024, Lehigh University, Center for Innovation in Teaching and Learning (CITL), To collaborate with CITL staff on active learning, with a focus on discussion, interaction, and peer feedback. Students will learn about the fundamentals of A.I., including using A.I. as a resource and framing ChatGPT questions effectively.

Educational Grant, Fall 2024, Lehigh University, Center for Ethics

Health Management Associates Intellectual Assessment - 99th percentile in analytic abilities