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Revitalizing the Healthcare Market: An Analysis of Hospital Pricing Transparency Compliance

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ABSTRACT

The healthcare industry is one of the most praised industries in the US due to its life saving capabilities and immersive care. Consumers regularly report that are satisfied with the care they receive from their physicians. Conversely, they also report frustrations and confusions associated with the costs of such care. In extreme cases, this frustration can turn to financial ruin as medical debt is the leading cause of bankruptcy in the US. The healthcare industry does not operate in congruence with other markets, largely due to the presence of insurance and other third-party payers. The undisclosed interactions between third party payers and medical providers have led to runaway costs for consumers. An additional challenge to the market is the pricing secrecy found within hospitals and other healthcare systems. The federal government identified this injustice and on January 1, 2021, the Hospital Price Transparency rule went into effect. Since this ruling, there has been a wide range of hospital compliance by state. Some previous literature suggests that the most compliant hospitals exist in urban and unconcentrated markets, whereas other literature disputes this. This research aims to uncover additional demographic and economic similarities between states that may be contributing to compliance rates. Data collected through sources such as the Patient Right Advocate (PRA) and Bureau of Economic Analysis (BEA) were analyzed using multivariate regression to determine the most impactful factors of compliance. The analysis did not indicate any significant variables that may predict compliance. Further research would likely benefit from being conducted on the hospital level rather than the state level.

INTRODUCTION

National health expenditure accounts for 18.3% of the nation's GDP, meaning on average, a person spends $12,900 on healthcare each year (CMS, 2023). Business is plentiful for

healthcare providers; however, consumers may be overpaying for the care they receive. 62% of bankruptcies are caused by medical debt, making in the leading cause of bankruptcy in the US (Amadeo, 2016). The healthcare industry's market and pricing structure has left America in a financial crisis that has impacted citizens across all demographics. A major market complexity is the role of third-party payers, like private insurance and Medicare. These third-party payers coordinate with healthcare providers and consumers to partially cover cost the care. However, the conversations between third-party payers and providers are largely obscure from the public. Hospitals and insurance providers do not adequately provide information on their pricing and overall rates of care. This actively prevents consumers from making objective choices regarding their health. By withholding these prices, consumers are unable to shop for their services like they may do in other markets. This leads to confusion and frustration for consumers when they receive massive bills in the mail post treatment. After attending a rehab facility that was initially covered by insurance, a 28-year-old New Jersey man was encouraged to attend an outpatient program which he was told would also be covered. However, after completing the program, he was hit with a $40,000 medical bill (Ponsot and Moritz-Rabson, 2016).

Often times, hospitals set their negotiated insurance prices higher that the price of care for a consumer that was paying in cash. Hospitals may be setting these prices to incentivize cash paying consumers so that hospitals can cut administrative costs associated with filing insurance claims (Bai and Fisher, 2023). In many cases, hospitals are attempting to raise, namely their negotiated prices, noting that the additional funds will go to nurse's salaries. However, nurse's salaries only make up a mere 25% of hospitals costs, meaning that there is little to no justification for the significant increase in prices (Fisher, 2022). These raising rates will

substantially impact consumers who are enrolled in high deductible plans who will have to pay out of pocket until they meet their deductibles.

Nurses, doctors, and other healthcare professionals are not blind to these disguised rates. However, they choose to turn a blind eye, even when the profits gained do not impact them, namely due to the institutional culture found inside each hospital in America. Marty Makary, MD reveals his firsthand experience of the ignorance of hospitals in his book *Unaccountable: What Hospitals Won't Tell You and How Transparency Can Revolutionize Health Care.* Dr. Makary estimates that financial incentives lure the average doctor two to ten times a day (2012, p. 4). Though these incentives are not always acted on, many doctors are quick to overtreat patients. This suggests that medical professionals may send patients to surgeries that could have been taken care of with physical therapy or put patients on medications for conditions that may only require some Advil. It is unsettling to believe that there are dangerous doctors that profit off of runaway costs, but Dr. Makary states they are in every hospital, in every state. These doctors are so prevalent that 9.5% of US deaths are caused by medical errors. It is additionally alarming that colleagues of these doctors ignore their negligence due to the underlying hierarchy and cultural structure of the medical world. Makary states even he had fallen victim to this ignorance during his time in residency. He recounts numerous times in which he wishes he had stepped in and told a patient to receive care from a different physician because he knew their condition could be resolved with a cheaper, safer alternative. Pricing transparency would readily combat the malpractices that are occurring through utilization of the free market.

Hope is not lost in terms of healthcare cost reduction. On January 1st, 2021, the Biden administration enacted The Hospital Price Transparency rule. The ruling states that any hospital operating in the US must post a machine-readable file (MRF) composed of all standard charges

on all items and services accessible in that particular hospital. Additionally, they must post a consumer-friendly display of these charges. This requirement can be met through a price estimator tool that will consider a person's individual insurance policies (CMS, 2023). The goal of these MRFs and estimation services is to revolutionize the healthcare industry into functional, competitive market that is built for consumers. By making these rates readily available it will not only reduce the cost of service, but it will also improve the quality overall.

Since 2021, transparency progress has generally plateaued. Patient Rights Advocate (PRA) is a nonprofit that monitors individual hospital compliance under the 2021 ruling. In their most recent semi-annual report, they estimate that only 24.5% of hospitals are fully compliant (PRA, 2023). Though the majority of hospitals have posted some form of pricing files, most of them are incomplete or unusable due to the complexity of such. The Centers for Medicare & Medicaid Services (CMS) are the primary enforcers of the transparency rule and are able to administer civil monetary penalties (CMPs) to noncompliant hospitals. However, since the rule's inception, only three hospitals have been fined, the highest fine being $883,180. Though CMS has recently announced that they will be increasing enforcement by automatically imposing CMPs on hospitals that fail to submit a corrective action plan within 45 days following their request, there are still major strides that can be taken (Morse, 2023). This research hopes to contribute to the greater movement of healthcare cost reduction by uncovering the factors that allow these noncompliant hospitals to continue to operate, along with determining corresponding qualities among such hospitals.

BACKGROUND

The financial system of the healthcare industry operates in a complex manner which is unlike most other markets. This complexity is largely due to the reimbursement negotiations

between Medicare services, private insurance, and healthcare providers. Aside from the revenue generated from these entities, there are alternate way to secure profits. Nonprofit hospitals are able to achieve tax exemptions and many physicians seek to secure better contracts with pharmaceutical suppliers to increase their profits. These alternates may lead to hidden objectives and increased rates for patients .

Hospitals can be grouped into three financial sectors, in which there are private, public, and nonprofit institutions. Hospitals that operate privately are funded by investors and shareholders, whereas public hospitals are financed by either state or local governments. The majority of American hospitals fall into the third category of nonprofit institutions.

Over two-thirds of the nation's hospitals are nonprofits, meaning they are exempt from paying property, income, and sales taxes. Additionally, considerable donations and bonds may be made to these hospitals free of taxation. This status is earned through mandatory "community benefits" provided by each hospital. Community benefits are defined as any program, investment, or initiative that provides treatment in response to community needs. The most common form of benefit is charity medical care, which is free or discounted treatment that may be given to individuals in need. The original purpose of nonprofit hospitals was to provide such charity medical care to their low-income patients. Before 1969, to earn tax exemption status, charity medical care was legally required to be part of the community benefits performed at each nonprofit hospital. However, that same year, the requirements were changed, and hospitals were granted the ability to decide what they deemed sufficient in terms of their own community benefits, leading to a significant decrease in their original charitable goal. Unfortunately, this trend has only increased in recent years. Since the enactment of the Affordable Care Act in 2010, the top seven nonprofit hospitals (by revenue) decreased their spending on charity care by $150

million each year (Diamond, 2017). In theory, community benefits should equal the value of tax exemption earned by nonprofits, but in reality, many hospitals are not investing back into the care of their patients and the excess revenue is going to executive salaries and billboard ads. Over half of the US's nonprofit CEOs have salaries over $2.5 million. The highest paid executive, out of Phoenix, Arizona, earned $21.6 million in 2019 (Marni, 2020).

Large scale hospitals and healthcare systems are not the only who benefit from the overwhelming ambiguity found inside the industry. Each year Americans will contribute $100 billion to doctors salaries (Barker, 2017). Doctors work with insurance companies to generate this revenue through office visits, procedures, and ordering tests and prescriptions (Gorke, 2021). This suggests that the more patients a doctor sees and treats, the more money will fall into his pocket. Furthermore, doctors are legally allowed to receive nonmonetary incentives from pharmaceutical companies such as meals and travel expenses. This implies that doctors may be more willing to prescribe a patient with a particular- often times pricier- drug. The healthcare industry continues to excessively profit at the hands of consumers due to the financial structure it is built upon.

LITERATURE REVIEW

Several recent studies have not only advocated for the need for pricing transparency but have also evaluated hospitals compliance rates since the inception of the pricing transparency ruling in 2021. Supporters of this effort express that even with market complexities, such as insurance, transparency can reform the healthcare market to be consumer-friendly by lowering costs and improving care. Numerous researchers have further analyzed transparency compliance rates through various demographic, economic, and hospital specific factors.

The need for transparency is not limited to only prices in the healthcare industry. In a coalition of researchers for the Institute of Medicine, speakers vouch for different alternates to lower healthcare costs. Editors from the National Academic Press (US) state that transparency of costs, prices, quality of care, and effectiveness of care are all key tools to lower costs and improve outcomes for consumers (Yong et al., 2010).

John Santa, M.D., a speaker at the coalition, argues that patients are put at a disadvantage due to the structure of the market and the obscurity of pricing. A specific complexity of the market which further clouds pricing is the use of third-party payers, like private insurance. Insurers benefit healthy patients since they do not need to cover as many co-pays as they would for an unhealthy patient, burdening them even more. A further complexity to the market is the hidden relationships between physicians and pharmaceutical companies, hospitals, and other intuitions. When a consumer seeks care from a physician, they likely trust that they will take the necessary action needed to serve them. Though generally consumers are satisfied with their care, they are less than satisfied with the costs, as reported by the Consumer's Union (2009). Santa further suggests the use comparative effectiveness research to reduce the impact of these complexities. Though this idea has largely been met with claims that the market is too complicated for consumers to understand, consumers understand the fairness associated with the free market, in which they have some influence over the price of goods (Yong et al., 2010).

Van Horn, Laffer, and Metcalf (2019) advocate for pricing transparency stating that the use of the free market will reduce costs, while also creating opportunities for providers. Currently, pricing does not only vary from hospital to hospital, but also varies from patient to patient within each hospital. This spread of variation is largely due to the overwhelmingly complex role of insurance. Because of the different rates and plans associated with different

insurances, shopping for healthcare without transparency is impossible. Furthermore, because of the overall increase of complexity in the market, a wedge has been driven between providers and consumers, in which consumer preferences and experiences are no longer valued. The industry structure must be reformed into a consumer-driven market to enable patients to make financially sound decisions regarding healthcare.

Access to pricing data is an important step in market reformation because it allows consumers to compare prices. A study by the RAND corporation shows that if there was little variation in pricing, consumers would not bear the opportunity cost associated with shopping, meaning they would not waste time trying to find the best prices. If pricing data was readily available, consumers could clearly see they are disadvantaged if they chose not to "shop" due to the overwhelming variation in the market (Van Horn et al., 2019).

The demand for healthcare is relatively inelastic, meaning that a consumer's reaction to a change in price, in terms of quantity, will be small. Depending on the type of care, elasticity ranges from -.02 to -0.44 (Van Horn et al., 2019). The more inelastic the demand for healthcare is the less opportunity for cost reduction there is. The healthcare sector with the most opportunity for cost reduction is administrative costs. Administrative healthcare spending totals 8% of the US's GDP, which is almost triple of what other comparable countries spend. Health care waste is defined as the overutilization of services or practices that result in unnecessary costs to the healthcare system. Administrative complexities were the biggest contributors to health care waste in 2019. This indicates that even at fairly inelastic prices, transparency will still positively disrupt the market, leading to decreased prices and improved care for all (Van Horn et al., 2019).

After the enactment of the federal Hospital Price Transparency, numerous researchers estimated compliance to the ruling by analyzing to various factors that may explain differences

among hospitals. Firstly, researchers Haque, Ahmadzada, and Janumpally (2022) evaluated adherence to the ruling across US hospitals by looking at market and hospital level factors. Data was collected between July 1st and September 30th, 2021, for all hospitals registered with the Centers for Medicare and Medicaid Services. Aside from collecting information on adherence, they also collected hospital specific information such as total revenue quartiles, revenue per patient quartiles, hospital size, emergency services available, and hospital ownership. Market concentration was also calculated using the Herfindahl-Hirschman index (HHI). These variables were analyzed using logistic regression.

Upon analysis, there was found to be a significant difference in the proportion of adherent vs nonadherent facilities that were in unconcentrated or high concentrated markets. Worse adherence was generally associated with higher concentration. Total gross revenue had no significant impact on adherence, however, facilities with the lowest revenue per patient was associated with better adherence. The variables hospital size, emergency services available, and hospital ownership were not associated with adherence (Haque et al., 2022).

Generally, overall adherence to the ruling was poor. The most transparent facilities are likely to be acute care hospitals in urban and unconcentrated markets with lesser revenue per patient. Because the analysis was conducted shortly after the transparency ruling, long term trends regarding compliance rates following monetary penalties are yet to be evaluated (Haque et al., 2022).

An additional study was conducted in corroboration with Michigan State University and Johns Hopkins University to examine alternate factors associated with hospital compliance (Jiang et al., 2021). Data was collected through 2019 Medicare Cost Report and Turquoise Health, which is San Diego based data services company that specializes in aggregating hospital

pricing data. Along with data collection, Turquoise Health analyzed hospital compliance among all hospitals included in the 2019 Medicare Cost Report. Using this data, researchers created a binary compliance rating in which "noncompliance" denoted that no machine-readable file (MRF) was available, and "compliance" indicated that a MRF was posted with negotiated prices for at least one insurance plan (Jiang et al., 2021).

Potentially explanatory factors, based on previous literature, were determined to be ownership type, system affiliation, teaching status, location (urban vs non-urban), size, profit margin, and percentage of Medicare patient discharges. Additionally, to examine hospital's individual purchasing power, market share was computed by comparing each hospital's total discharges to the overall discharges in a certain hospital referral region (HRR). Discharges were used as an estimate of how many patients are served by each hospital. Furthermore, IT preparedness was evaluated by dividing health IT assets by total fixed assets. Finally, charge markup was examined by divided gross charge by Medicare-allowable cost. Multivariate regression analysis was used to understand the variation in 305 HRRs (Jiang et al., 2021).

Forty-five percent of hospitals were deemed to achieve the compliant status. In 64% of the HRRs, over half of the included hospitals were noncompliant. In 20 HRRs, 100% of hospitals were compliant. However, in 26 HRRs, there was 0% compliance. After rigorous testing, an adjusted R-squared of 0.195 was estimated. This indicates that that 19.5% of variation in compliance by HRR can be explained by the explanatory variables forementioned. The variables that deemed to be positively associated with compliance were IT preparedness, size, system affiliation, market share, profit ownership, and non-urban location (Jiang et al., 2021).

In resemblance to other research, there was widespread compliance across states and HRRs. It was found that hospitals behave in congruence with their peer hospitals in the same

market, which may indicate hospitals may be considering the behavior of similar institutions when making decisions regarding pricing transparency. The positive association between IT preparedness and compliance suggests that hospitals that allocate more funds to IT are more likely to comply with the transparency ruling. This may be because hospitals who fund their IT departments sufficiently may already have resources that make posting pricing lists much easier than hospitals who lack these resources. Additionally, system-affiliated, non-urban, and large hospitals in concentrated markets were found to have better compliance rates. Like IT preparedness, these hospitals are likely to have more resources, meaning pricing transparency can more easily be implemented. These factors indicate that overall compliance rating may be more dependent on financing and logistics rather than a lack of desire to disclose pricing, further indicating that the cost of compliance may be a barrier for certain hospitals (Jiang et al., 2021).

A final supplementary study conducted by researchers Younessi, Lin, Greenberg, and French (2022) sought to further predict transparency using similar regression methods. Data was sourced using the American Hospital Association (AHA) database. Specific characteristics regarding hospital demographics and regional classifications were identified using the AHA Annual Survey, along with the Census Bureau and the Department of Agriculture. Using a dataset from Turquoise Health, a list of 14 commonly used services, was aggregated. Each service was analyzed in terms of pricing transparency (Younessi et al., 2022).

Sixty-two percent of hospitals posted prices for at least one of the commonly used services. The least transparent service was electrocardiograms whereas the most transparent service were abdominal ultrasounds. However, no single service was associated with a compliance rate of 50% or more. The number of hospital beds were found to be marginally associated with transparency for most services. Again, it was concluded that the majority of

hospitals are not compliant with the transparency ruling. Hospitals with fewer beds advocated that they needed additional resources to be able to comply with the ruling. Furthermore, these facilities may lack the ability to offer comparable pricing due to economies of scale, leading to decreased transparency. Regionally, the South and West had the lowest rates of compliance. This may be due to decreased competition and market concentration found in these areas (Younessi et al., 2022).

DATA COLLECTION

In addition to the existing literature regarding hospital pricing transparency, several organizations have formed whose aim is to aggregate pricing data, empower consumers, and analyze hospital compliance nationally. Patient Rights Advocate (PRA) is a nonprofit who specializes in evaluating compliance and advocates for health care cost reduction. PRA's most recent report (February 2023) analyzed compliance of 2,000 hospitals nationwide from Dec. 22, 2022, to Jan. 26, 2023, specifically focusing on hospitals that belong to the largest healthcare systems. Each hospital website was analyzed for compliance based on the following criteria:

- Machine-readable files for all items and services including:
    - Associated costs, description of each item or service, gross charges, negotiated minimum and maximum charges, and payer-specific negotiated charges/identification of charges with the name of third-party payers and plan
- Price display of the 300 most common shoppable services in the form of either in in a consumer-usable standard charges display or a price estimator tool

Data regarding each of the 50 states compliance rates were sourced from this report.

To potentially understand characteristics that contribute to variance by state, both hospital specific and macroeconomic data was gathered. Hospital ownership (government, non-profit,

and for-profit) and total health care expenditure by providers (including hospital care, physician services, nursing home care, prescription drugs, etc.) was obtained from the Kaiser Family Foundation (KFF). Gross patient revenue was sourced from the American Hospital Directory (AHD), which utilizes data from hospital's most recent Medicare report. GDP per capita, population, unemployment rate, median income, and high school graduation rate serve as indicators of economic status by state. These variables were sourced from various government organizations including the Bureau of Labor Statistics, the Bureau of Economic Analysis, and the Census Bureau.

Variables	Description
PCTCOMPLIANT	Percentage of compliant hospitals by state (2023)
GDP_PER_CAP	Real per capita gross domestic product, by state (2022)
POPULATION	Population by state (2022)
UNEMPLOY	Annual unemployment rate, by state (2022)
MEDINC	Median household income, by state (2021)
GRADRATE	High school graduation rate, by state (2022)
GOV_OWNED	All community hospitals owned by state or local government, by state (2021)
NONPROFIT	All community nonprofit hospitals, by state (2021)
FORPROFIT	All community for-profit hospitals, by state (2021)
TOT_PATIENT_REV	Total patient revenue, including inpatient and outpatient, by state (2021)
TOT_EXP_PROV	Total healthcare expenditure of providers, by state (2020)

Figure 1: Variable Descriptions

This research will utilize the 11 variables defined in *Figure 1* to assess corresponding factors that may impact transparency compliance. There are moderate limitations to further analysis that result from the data collection. The true hospital compliance rates are impacted from the reduced sample size of only 2,000 out of the 6,000 US hospitals. Furthermore, the data

reflects four different years. However, since the analysis is conducted on a macro-scale level, there will not be significant variance from year to year.

Variable	Minimum	1st Quartile	Mean	3rd Quartile	Maximum
PCTCOMPLIANT	0.00	13.00	23.96	35.50	78.00
GDP_PER_CAP	35,556	48,215	55,330	62,508	79,434
POPULATION	580,000	1,947,500	6,650,400	7,682,500	39,030,000
UNEMPLOY	2.10	2.75	3.40	3.97	5.40
MEDINC	46,637	62,740	71,156	80,398	97,332
GRADRATE	75.10	82.27	85.57	88.38	91.70
GOV_OWNED	0.00	3.25	18.88	27.75	99.00
NONPROFIT	5.00	32.00	59.42	70.50	207.00
FORPROFIT	0.00	4.25	24.64	25.75	266.00
TOT_PATIENT_REV	3,616,060	18,912,982	92,277,504	100,400,418	601,277,599
TOT_EXP_PROV	4,943	18,191	66,831	75,198	410,903

Figure 2: Descriptive Statistics

Figure 2 summarizes variables associated with hospital compliance. The percentage of compliant hospitals ranges from 0% compliance to 78% compliance, though, the average compliance rate is only 23.96%. The average GDP per capita is $55,330, maxing out at $79,434. The average population is $6.65 million, and the average unemployment rate is 3.4%. Median household income ranges from just over $46,000 to just under $100,000. The mean high school graduation rate is 85.57%. On average, there are 19 government owned hospitals, 59 nonprofit hospitals, and 25 for-profit hospitals in each state. Each state has at least 5 nonprofit hospitals, some having 0 government owned or for-profit institutions. Total patient revenue significantly exceeds total provider expenditure. The average revenue is $92 million where the average expenditure is $66 thousand.

THEROTICAL MODEL

A theoretical model was formed to assess relationships regarding the forementioned hospital specific, macroeconomic variables and compliance rates by state.

$$PCTCOMPLIANCE = \beta_0 + \beta_1 * \beta_{GDP\_PER\_CAP} + \beta_2 * \beta_{POPULATION} + \beta_3 * \beta_{UNEMPLOY} + \beta_4 * \beta_{MEDINC} + \beta_5 * \beta_{GRADRATE} + \beta_6 * \beta_{GOV\_OWNED} + \beta_7 * \beta_{NONPROFIT} + \beta_8 * \beta_{TOT\_PATIENT\_REV} + e$$

A positive relationship is expected, based on previous analyses, between compliance and the macroeconomic factors GDP per capita, population, median income, and graduation rate. According to literature from Jiang et al. (2021) and Younessi et al. (2022), compliance rates may be impacted by economies of scale and resource allocation. Hospitals in richer states are likely able to fund hospital departments that may be lacking resources in other states, such as IT and administration. Jiang et. al (2021) specifically noted that hospitals who had better IT preparedness displayed higher compliance rates. For corresponding reasons, unemployment rates are expected to have a negative relationship with compliance.

Hospital ownership is believed to significantly impact compliance rates. Government owned facilities are likely to have increased compliance rates, whereas nonprofit facilities are likely to have decreased rates. Literature from Dr. Danielle Ofri (2020) expresses that nonprofit hospitals are critical of transparency because they fear that it will impact their tax exemption status. Nonprofit hospitals cling to this status so that they can continue to have enlarged profits. Additionally, total patient revenue is expected to have a negative relationship with compliance. Hospitals that excessively profit off of their patients are likely additional critics of transparency and its overall goal to lower the cost of healthcare.

RESULTS

Upon analysis of the theoretical model, preliminary regressions were tested. The variables population and total patient revenue were found to be highly correlated and were therefor eliminated from the model to prevent multicollinearity. Further regression analysis was performed to test the significance of the remaining variables.

Initial Results

	Dependent variable:
	PCTCOMPLIANT
GDP_PER_CAP	-0.000001 (0.000004) t = -0.1887
UNEMPLOY	0.0526 (0.0390) t = 1.3476
MEDINC	0.000001 (0.000003) t = 0.2524
GRADRATE	1.5066 (0.6783)** t = 2.2211
GOV_OWNED	-0.0008 (0.0014) t = -0.5712
NONPROFIT	-0.00005 (0.0007) t = -0.0674
Constant	-1.2298 (0.6581)* t = -1.8686
Observations	50
R^2	0.1247
Adjusted R^2	0.0026
Residual Std. Error	0.1736 (df = 43)
F Statistic	1.0212 (df = 6; 43)
Note:	*p<0.1; **p<0.05; ***p<0.01

Figure 3: Initial Regression Output

Figure 3 displays the results of the regression. The adjusted R-squared of the model is 0.0026, meaning that only 0.26% of the variation in compliance rates can be explained by the independent variables. All of the potential explanatory variables were found to be insignificant at the 5% alpha level, excluding graduation rate. The analysis estimated that as graduation rate increases by 1%, compliance rates will increase by 1.5066 percentage points. This relationship was expected based on previous literature. States with higher graduation rates are likely to be wealthier and of a higher socioeconomic status. This indicates that the implementation of transparency may be easier in such state's hospitals.

In order to attribute more explanatory power to the model, two additional datasets were derived. States were split into low compliance (21% and below) and high compliance (22% and above). This cutoff was selected based on the average compliance rate (23.96%). Twenty-four states were included in the low compliance dataset whereas 26 states were included in the high compliance dataset. Alternate, yet similar models to that of the original model were used to estimate results.

Low vs High Compliance Regression Results		
	Dependent variable:	
	PCTCOMPLIANT	
	(1)	(2)
GDP_PER_CAP	-0.000002	0.00001
	(0.000003)	(0.000004)
	t = -0.6943	t = 1.3738
UNEMPLOY	-0.8897	0.0407
	(3.3752)	(0.0370)
	t = -0.2636	t = 1.1011
MEDINC	-0.000001	-0.000001
	(0.000003)	(0.000003)
	t = -0.3554	t = -0.2105
GRADRATE	-0.0183	1.1507
	(0.4216)	(0.9257)
	t = -0.0434	t = 1.2430
GOV_OWNED	0.0010	0.0014
	(0.0008)	(0.0023)
	t = 1.2531	t = 0.6277
NONPROFIT	0.0005	-0.0013
	(0.0004)	(0.0008)
	t = 1.1792	t = -1.5795
Constant	0.2825	-0.9782
	(0.4327)	(0.8747)
	t = 0.6528	t = -1.1183
Observations	24	26
R^2	0.3200	0.2654
Adjusted R^2	0.0800	0.0334
Residual Std. Error	0.0762 (df = 17)	0.1305 (df = 19)
F Statistic	1.3332 (df = 6; 17)	1.1439 (df = 6; 19)
Note:		*p<0.1; **p<0.05; ***p<0.01

Figure 4: Final Regression Results

The final results display similar findings between low and high compliance states. There are no significant variables in either model, however, both adjusted R^2 values have increased from the initial results. The low compliance model has a value of 0.08 and the high compliance model has a value of 0.0334, meaning the low compliance model has slightly more explanatory power. Further econometric testing, including sensitivity analysis and alternate model specifications, is needed to determine potentially significant variables.

CONCLUSIONS

The results of analysis were disappointing. All models produced relatively low adjusted R^2 values. This indicates that though the models have some explanatory power, it is not being captured by the current independent variables. This is likely due to omitted variables. Omitted variables are variables that should be included in the model but are currently in the error term. These variables can also create bias, meaning some coefficients may be over or underestimated.

The macroeconomic variables used in the model may have been on too large of a scale to predict compliance rates. It is likely that compliance rates are dependent on very specific factors, such as IT preparedness (Jiang et al., 2021) or per patient revenue (Haque et al., 2022), that differ from hospital to hospital. This may be why CMS struggles to regulate compliance and why only three CMPs have been issued among the thousands of non-compliant hospitals. This analysis would likely benefit from being conducted on the hospital level rather than the state level. Additional research would also benefit from the inclusion of more hospital specific variables to avoid potentially omitted variables. However, if compliance remains low among hospitals, it will be difficult to gather meaningfully data for further analysis.

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APENDIX

```
library(stargazer)

data$POPULATION = data$POPULATION*1000000
data$UNEMPLOY = data$UNEMPLOY/100

cor(data)

FullComplianceModel <- lm(PCTCOMPLIANT ~ GDP_PER_CAP + UNEMPLOY + MEDINC
+ GRADRATE + GOV_OWNED + NONPROFIT, data = data)
summary(FullComplianceModel)
stargazer(FullComplianceModel,
        type = "html",
        digits = 4,
        report = ("cv*s*t"),
        title = "Initial Results",
        out = "initialoutput.htm")

LowComplianceModel <- lm(PCTCOMPLIANT ~ GDP_PER_CAP  + UNEMPLOY +
MEDINC + GRADRATE + GOV_OWNED + NONPROFIT , data = LowCompliance)
summary(LowComplianceModel)

HighComplianceModel <- lm(PCTCOMPLIANT ~ GDP_PER_CAP  + UNEMPLOY +
MEDINC + GRADRATE + GOV_OWNED + NONPROFIT, data = HighCompliance)
summary(HighComplianceModel)

stargazer(LowComplianceModel, HighComplianceModel,
        type = "html",
        digits = 4,
        report = ("cv*s*t"),
        title = "Low vs High Compliance Regression Results",
        out = "finaloutput.htm")
```