

# Analyzing the Financial Performance of Nursing Homes

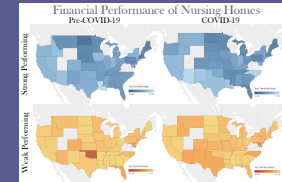
2024 Business Analytics Competition @ Manhattan College

Alexandra Kassian, Pavlo Mysak, Svetlana Doronkina, Advisor: Dr. Ai Ren



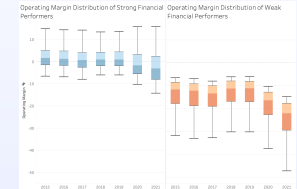
## 1. Introduction

Due to demographic changes and the growing needs of an aging population, nursing homes are now seen as an attractive option for investors looking for stability and diversification. To evaluate the validity of this investment strategy, we must thoroughly explore the financial performance of nursing homes, as well as the main factors that influence it.



## 2. Methodology

Financial performance can be evaluated through profitability ratios, with consideration for the long and short-term. Traditionally, investors focus on metrics like Net Profit Margin, Debt to Equity Ratio, etc; the strongest measure for our data is **Operating Margin** because it accounts for **long and short-term performance**, as well as **Net Income** and **Operating Expenses**.



We looked to investigate three categories of metrics:

**Staffing:** Due to tightening federal regulations regarding registered nurse hours per resident day and number of certified beds, it is important to consider staffing mix.

**Facility:** Many providers receive reimbursements through Medicare and Medicaid which directly impacts their **liquidity**. It's also crucial to consider ownership status because it determines pricing strategy and funding.

**Quality:** In lieu of outcome variables, the five-star rating system is the industry standard for measuring quality of facilities.

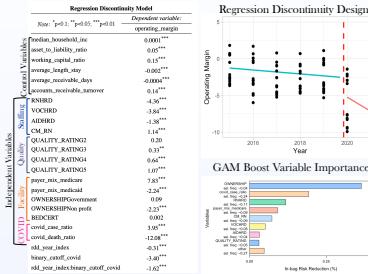
**COVID:** Facilities faced financial hardship due to this shock, and this impact was important to quantify.

Some **limitations** of our analysis are due to inaccuracies from human error in the self-reporting of our data. Because of the complex nature of the data surrounding healthcare facilities, another **limitation** is a lack of environmental stability due to constant regulation changes and ethical pressures.

## 3. Model

Our primary model is a **Regression Discontinuity Model** using a non-parametric method. The non-parametric method provides estimates based on data closer to the cut-off which effectively reduces bias. To further reduce bias, we introduced control variables and location-varying factors to enhance internal validity. This model will allow us to not only estimate and identify the impact of significant factors, but it will also let us estimate the effect of COVID-19 on the **operating margins** of facilities.

Operating Margin<sub>it</sub> =  $\beta_0 + (\text{Control Variables})_{it} + (\text{Independent Variables})_{it} + \beta_1(\text{RDD Year Index}) + \beta_2(\text{Binary Cutoff Covid}) + \beta_3(\text{RDD Year Index} * \text{Binary Cutoff Covid}) + \epsilon_{it}$



## 4. Influential & Significant Factors

### Facility:

- When the **payer-mix** is more weighted towards **Medicare**, facilities receive more funding and generally perform better. When there is more weight on **Medicaid**, facilities have lower reimbursement rates and uncompensated care from Medicare residuals.
- Facilities tend to perform better when their **ownership status** is **for-profit** or **government** rather than **non-profit**.

### Staffing:

- The costs of **nurse staffing** are inherently damaging to a provider's operating margin, so it is critical to determine the right **staff case mix**.

### COVID:

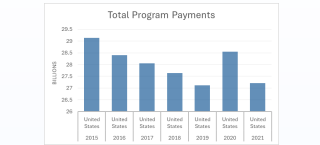
- Nursing homes were able to financially benefit off an influx of **cases** and **extended government assistance** to minimize the impact of COVID.
- Even still, they were penalized and financially damaged when **deaths** arose.

### Quality:

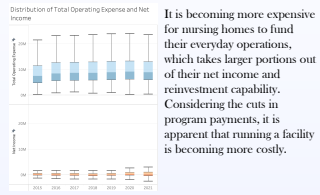
- There is a positive relationship between **quality rating** and financial performance. However, it is important for nursing facilities to keep in mind **legislation and regulation** that may impact their rating.

## 5. Evaluate Financial Performance

The financial performance of Nursing Homes is directly dependent on long-term outlook and pricing strategies. Strong Performing Facilities were able to readily adapt, whereas Weak Performing Facilities were the target groups of legislation.



The financial performance of nursing facilities is heavily reliant on Medicare and Medicaid funding, which has been steadily decreasing over the years.

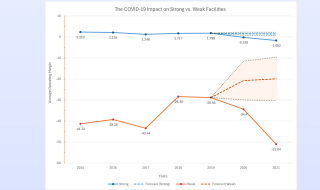


## 6. Trends in Performance & COVID-19 Impact

Prior to **COVID-19**, the **operating margin** among facilities was on a declining trend. This was further devastated by the pandemic. This trend is also seen in other financial variables as expenses consistently outweigh the inflow of income.

Furthermore, there is an increase in the dispersion of the **operating margin** at the onset of 2020.

The forecasted operating margin is significantly higher than the actual, following the shock of COVID-19.



## 7. Recommendations & Analysis

Investing in nursing home facilities can be morally fulfilling, however, it does not come without its risks. Following the **COVID-19** pandemic, many facilities suffered from decreasing **occupancy rates**, increasing **operating costs**, and reputational damages due to **outbreaks**.

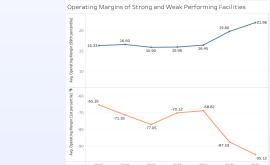
When selecting a nursing home to invest in, we've concluded that there are a few qualities to look out for to maximize your chances of a worthwhile investment.

1) **Staffing Levels:** There is a nuanced balance between **registered nurse hours per resident day** and the **case mix of registered nurses**. Our recommendation is not to look at staffing hours per resident days, but rather the case mix of registered nurses. A higher **case mix of registered nurses** will positively impact a facility's **operating margin** and provide more experienced care to patients.

2) **Facility:** We recommend selecting facilities with a larger payer mix coming from **Medicare**. **Medicare** payments are more reliable and standardized than **Medicaid** payments and tend to improve a facility's financial health. When surveying **ownership status** of a facility, we recommend looking at **for-profit** or **government** owned facilities, with a preference toward the latter.

3) **Quality:** While **quality** can be subjective, we see that as the industry-standardized five-star system goes up, the estimated **operating margin** will also positively increase. Therefore, as far as quality goes, shoot for the stars!

We recommend creditors invest in historically Strong Performing Facilities resembling the qualities listed above.



The economic viability of nursing homes is often challenged by inconsistent quality factors and funding; however, the worth of nursing homes transcends beyond financial metrics. These facilities are crucial for those in need, so there is an utmost importance of ensuring quality support for these facilities.

## Data Sources & Tools



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Phase 2:

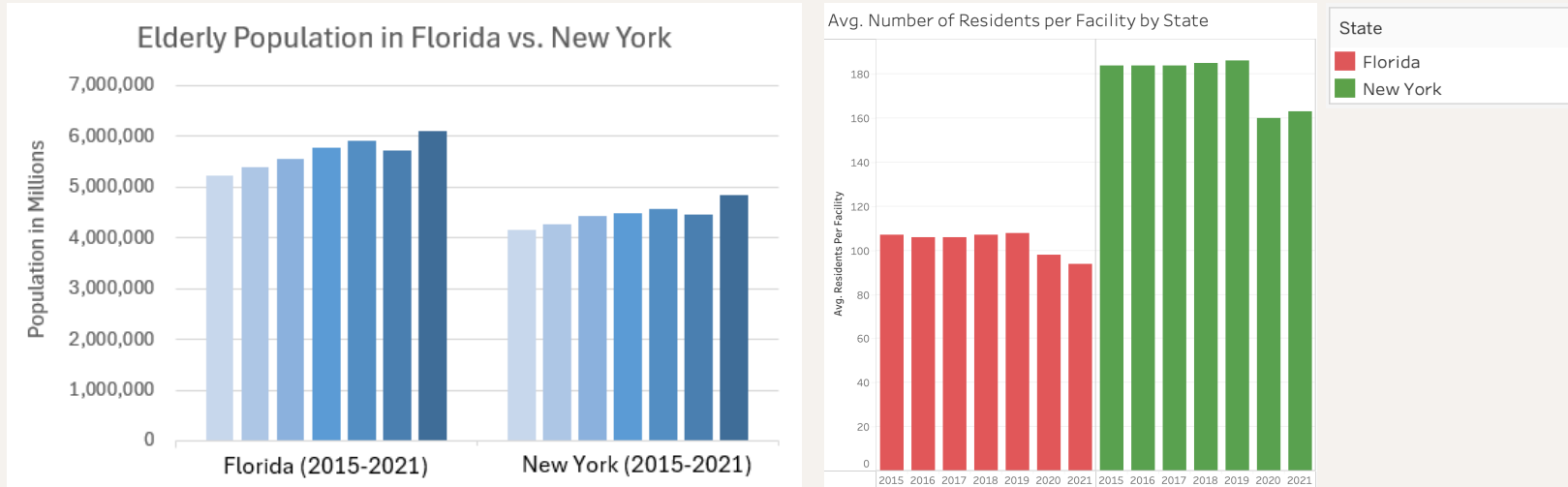
# Nursing Home Financial Performance New York vs. Florida

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Advisor: Ai Ren



# Introduction



- On average, Florida has over **1 million** more elderly residents than New York.
- Florida has over **630 facilities** in comparison to New York's **400 facilities**.

# Methodology

```
graph LR; A((Establish Research Questions)) --- B((Data Pre-processing)); B --- C((Identify Primary Financial Indicator)); C --- D((Data Visualization)); D --- E((Construct Model)); E --- F((Evaluate Findings))
```

Establish  
Research  
Questions

Data Pre-  
processing

Identify  
Primary  
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Indicator

Data  
Visualization

Construct  
Model

Evaluate  
Findings

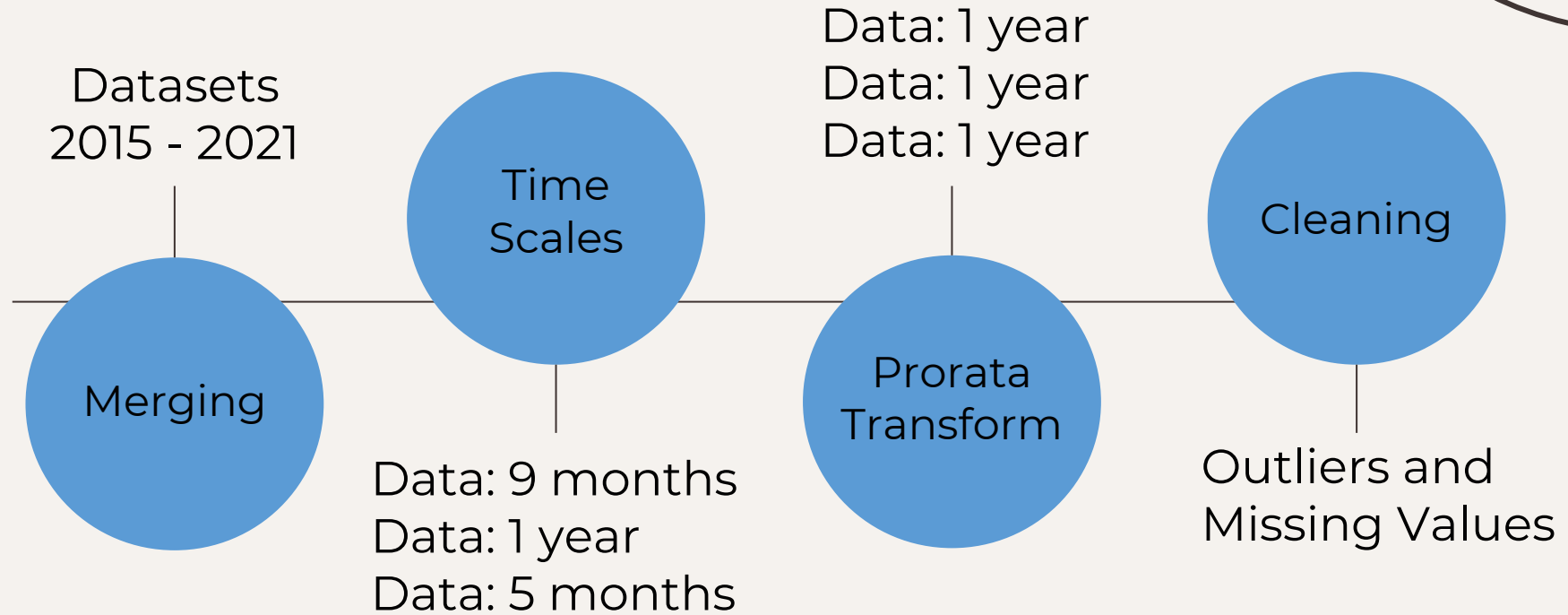
# Research Questions

1. How does the financial performance of nursing homes in New York and Florida compare in terms of operating margin?
2. What government regulations and policies influence the financial performance of nursing homes in each state?
3. How do the staffing levels, facility infrastructure, and quality ratings differ between nursing homes in the two states?
4. What are the trends in penalties and health deficiencies among nursing homes over the years?
5. How did the event of COVID-19 impact nursing homes in these states?

# Limitations

- Inaccuracies from human error in self-reporting nature of data
- Public-use only data
- Lack of environmental stability due to constant regulation changes and ethical pressures
- No outcome variables

# Data Preprocessing

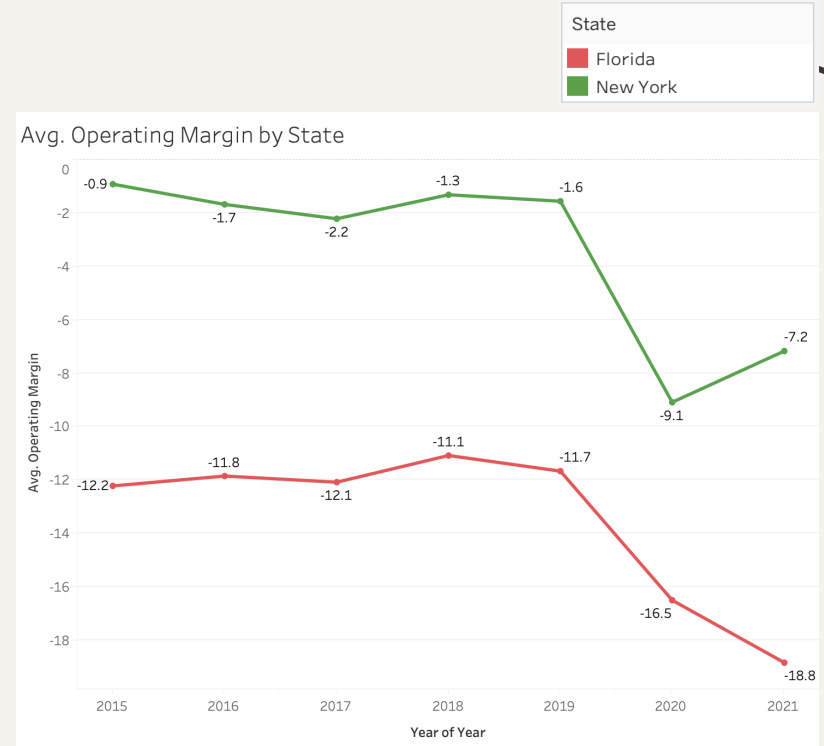


# Identifying Primary Financial Indicator

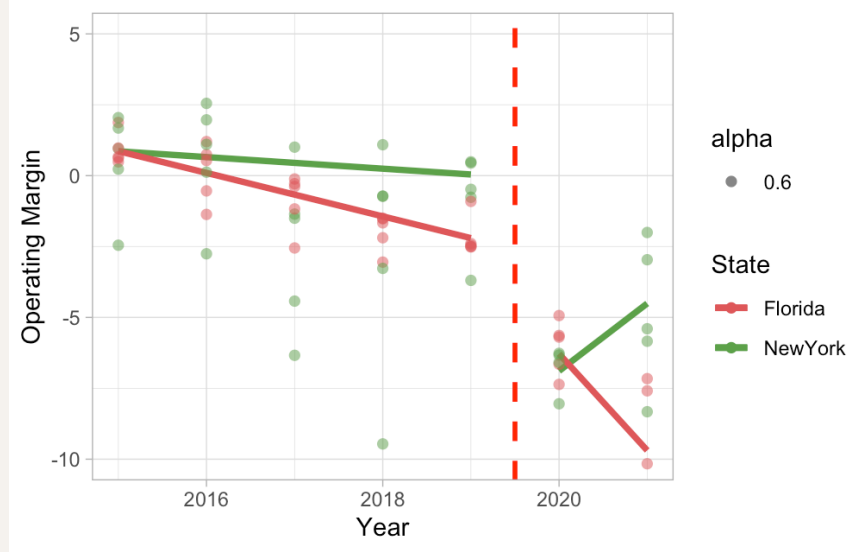
$$\text{operating margin} = \frac{\text{gross income} - \text{operating expenses}}{\text{revenue}}$$

- ✓ Short-term
- ✓ Long-Term
- ✓ Profitability

Ratios are more comprehensive than raw financial data.



# Model Construction



- Fixed Effects
- Regression Discontinuity Design
- Includes **staffing**, **quality**, **facility** and **COVID** variables per state

## Regression Discontinuity Models

*Note:*

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

*Dependent variable:*

operating\_margin

FL

NY

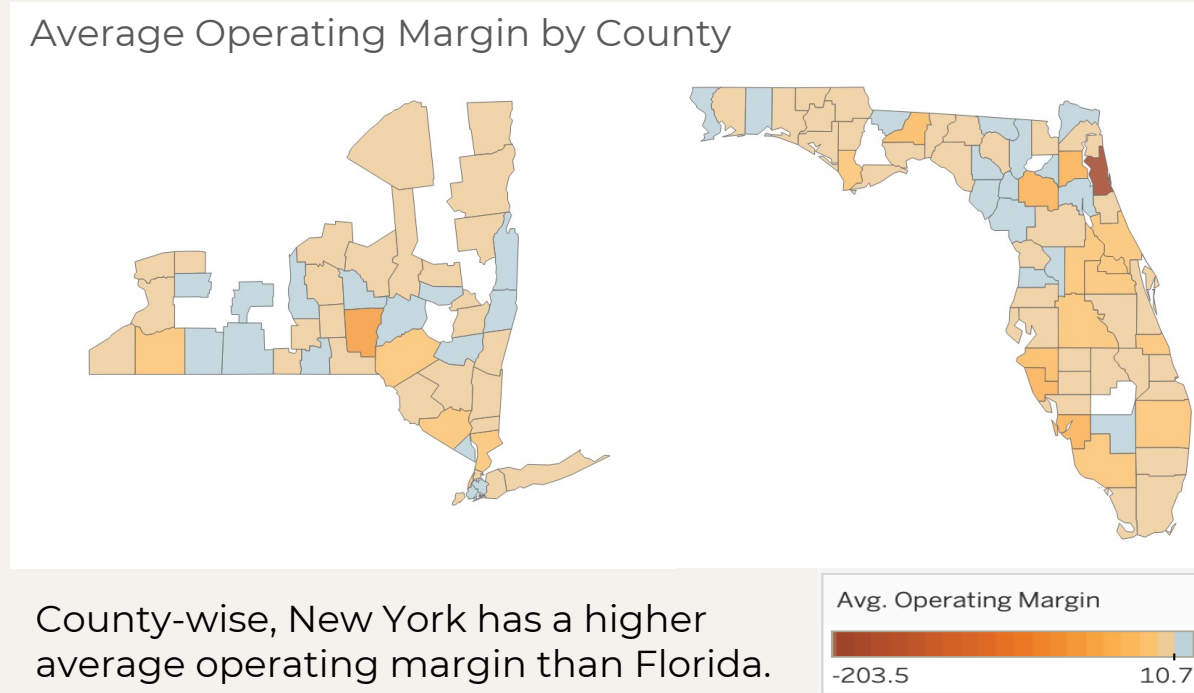
(1)

(2)

|                                    | FL<br>(1) | NY<br>(2) |
|------------------------------------|-----------|-----------|
| asset_to_liability_ratio           | 0.05      | 0.83***   |
| working_capital_ratio              | 0.16***   | 0.24**    |
| average_length_stay                | -0.004**  | -0.004**  |
| average_receivable_days            | -0.01**   | 0.01      |
| RNHRD                              | -3.27***  | -3.73***  |
| VOCHRD                             | -5.23***  | -0.82     |
| AIDHRD                             | -0.72*    | -1.82***  |
| CM_RN:binary_cutoff_covid          | 6.24*     | 9.88***   |
| QUALITY_RATING.2                   | 0.23      | -0.37     |
| QUALITY_RATING.3                   | -0.09     | -0.39     |
| QUALITY_RATING.4                   | 0.35      | -0.31     |
| QUALITY_RATING.5                   | 1.28**    | 0.64      |
| payer_mix_medicare                 | 8.70***   | 13.75***  |
| payer_mix_medicaid                 | -5.32***  | 1.14      |
| median_household_inc               | 0.0005*** | 0.0003    |
| OWNERSHIP.For.profit               | 1.50***   | 2.43***   |
| OWNERSHIP.Government               | 2.14      | -5.50**   |
| covid_case_ratio                   | 3.77***   | 2.01      |
| covid_death_ratio                  | -13.43*** | -10.85**  |
| binary_cutoff_covid                | -7.18***  | -11.79*** |
| rdd_year_index                     | -1.43***  | -0.88**   |
| binary_cutoff_covid:rdd_year_index | -0.57     | 4.35*     |

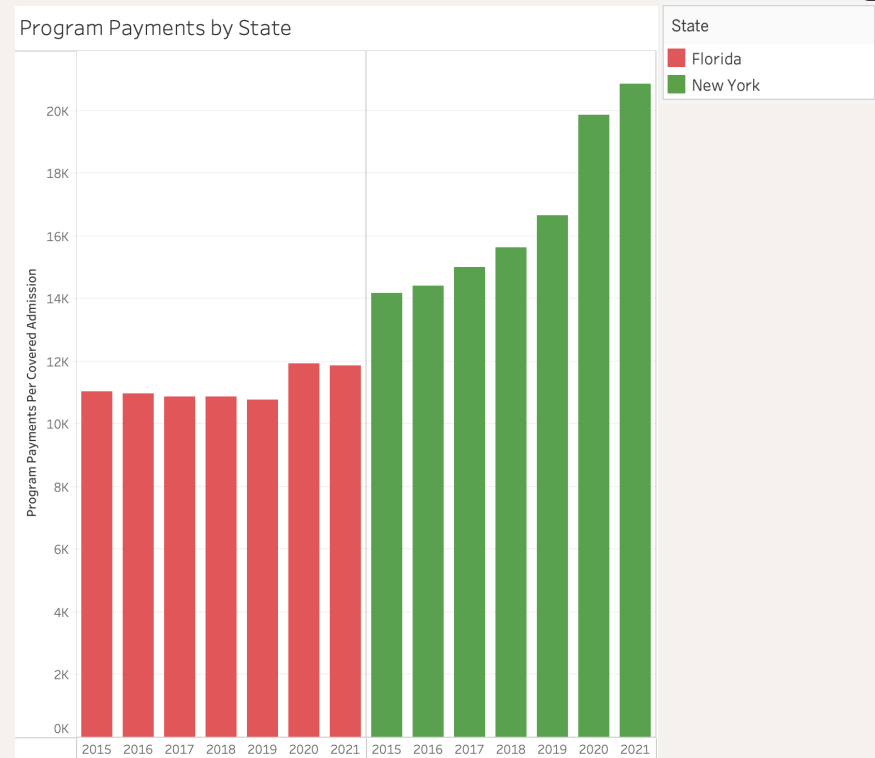
COVID Facility Quality Staffing

# 1. How do the financial performances of nursing homes in New York and Florida compare in terms of operating margin?



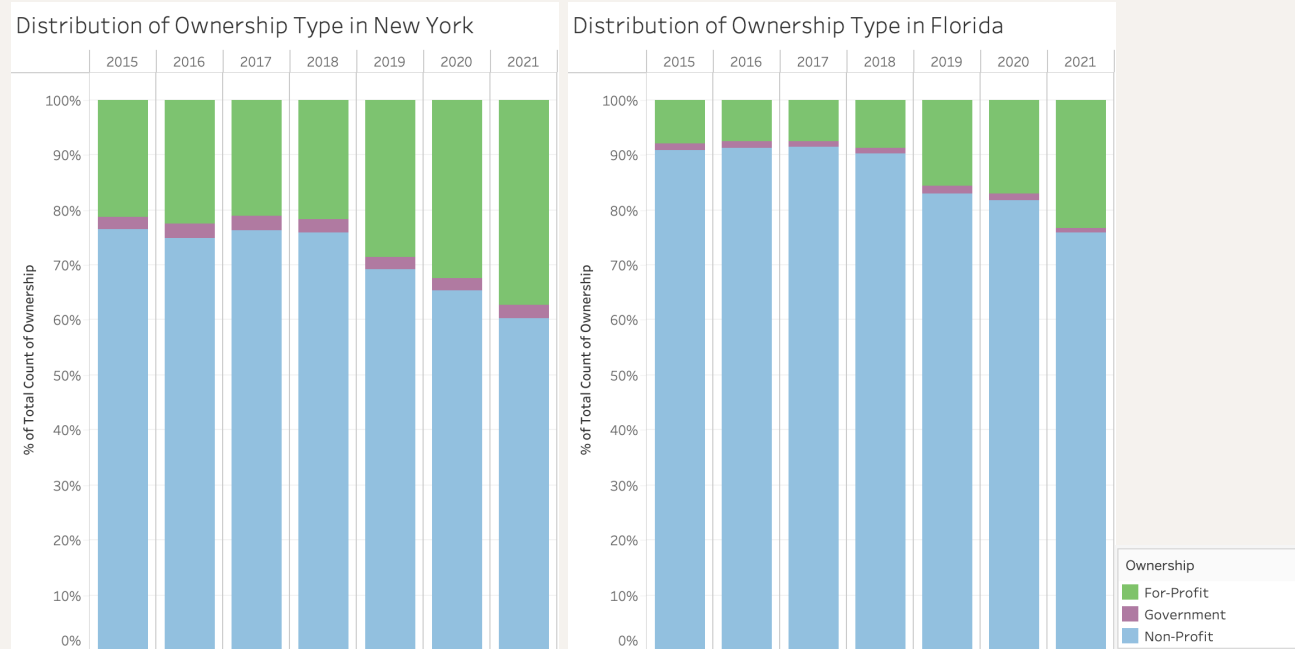
## 2. What government regulations and policies influence the financial performance of nursing homes in each state?

- New York saw **climbing program payments** while Florida stayed **stagnant**.
- Florida is pulling away from **government intervention** in healthcare.



### 3. How do the staffing levels, facility infrastructure, and quality ratings differ between nursing homes in the two states?

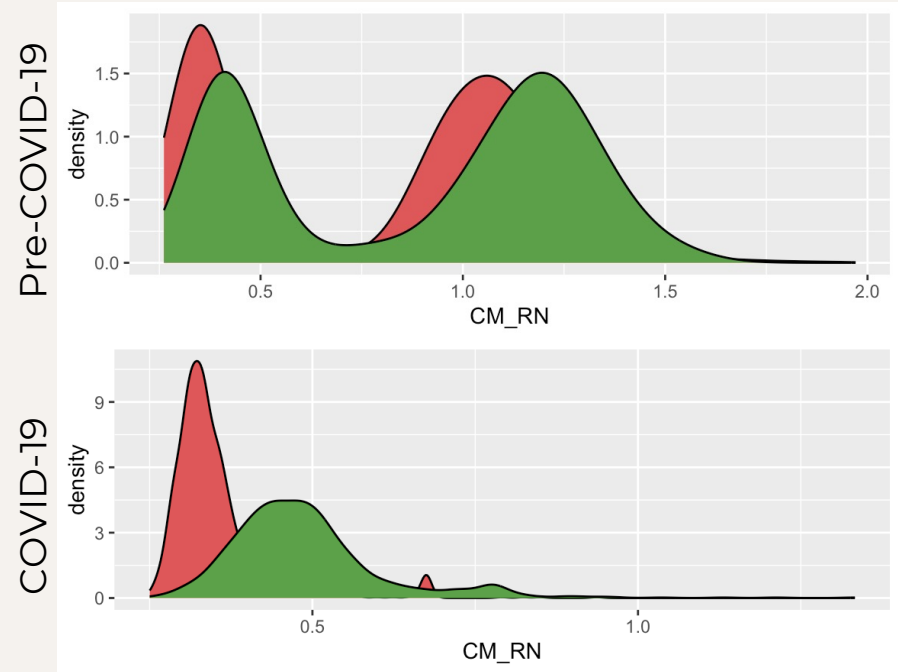
- **For-profit** facilities dominate both states.
- New York has more **government ownership** than Florida.



### 3. How do the staffing levels, facility infrastructure, and quality ratings differ between nursing homes in the two states?

- Similar distributions for most staffing levels.
- Noticeable shift and change in distribution of Case Mix of Registered Nurses post COVID-19.

Case Mix of Registered Nurses

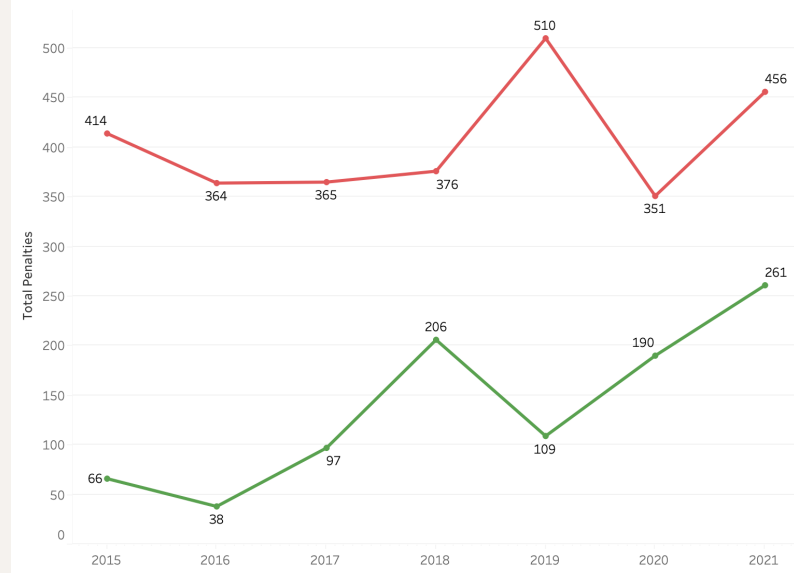


## 4. What are the trends in penalties and health deficiencies among nursing homes over the years?

Severity of Health Deficiencies by State



Total Penalties by State



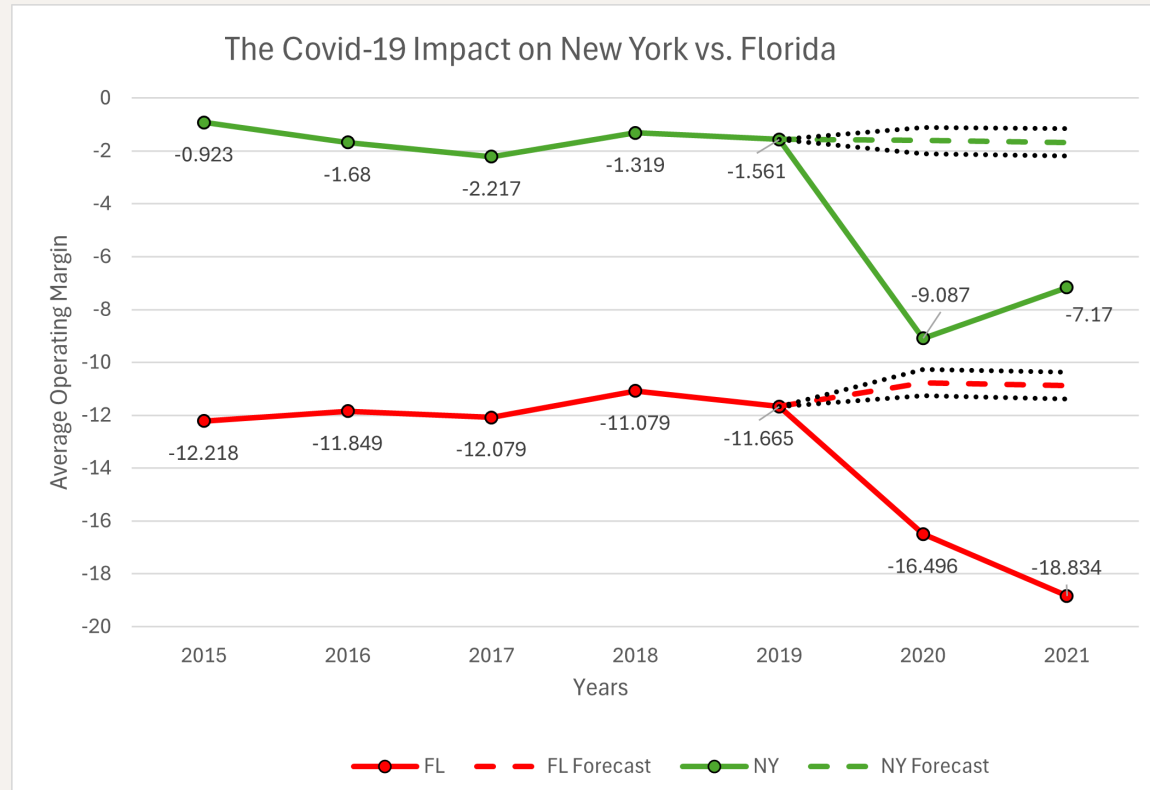
New York facilities have less penalties and health deficiencies than Florida throughout the years.

State

Florida

New York

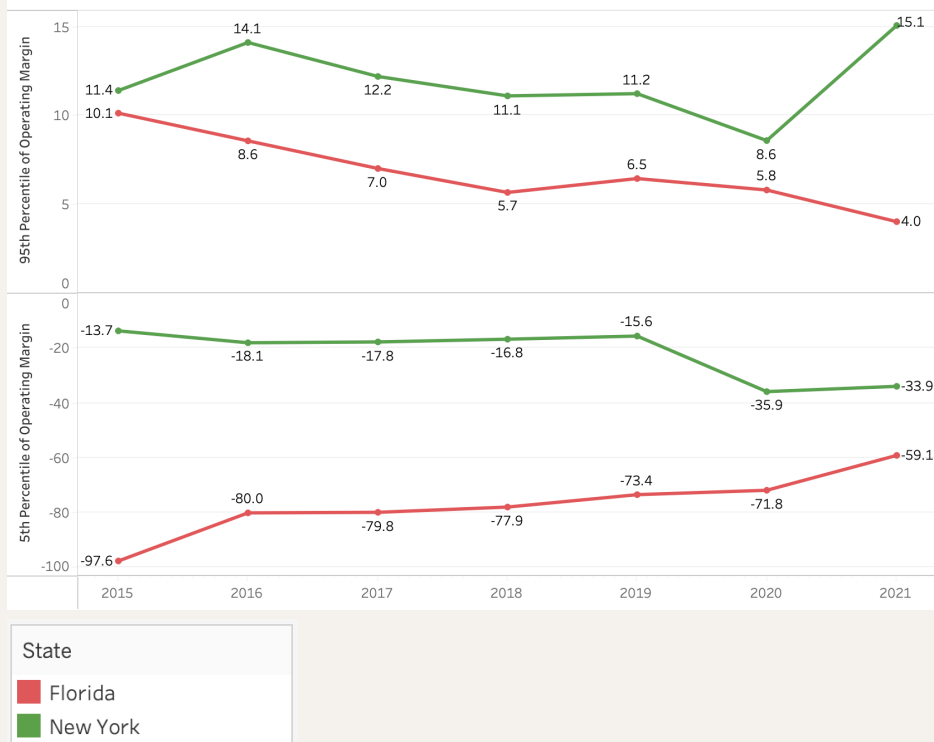
## 5. How did the event of COVID-19 impact nursing homes in these states?



\* 95% Confidence Interval

# Recommendations and Analysis

Strongest and Weakest Performance Facilities by State



Our investment recommendation is for-profit New York nursing homes:

- Consistently higher operating margin.
- Fewer penalties and resident health deficiencies.
- Strong COVID-19 recovery.
- Higher program payments and public funding.
- More efficient and higher quality care from nurse staff (RN Case Mix).

# Data Resources and Tools



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