A Statewide Exploration of Outperforming Nursing Homes: an Interactive Platform based on Covid-19 data

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Summary

Nursing homes were hit hard during Covid-19 pandemic. What are the reasons for the *high death rate*? We performed large-scale analysis to determine NH features that caused high death rate. An *interactive platform* is also provided to help people find best NHs nearby.

Dataset

We downloaded and merged two dataset from CMS: COVID-19 Nursing Home Dataset and Nursing Home Provider Info Dataset. They contain 14000 NHs with over 160 features from June to October 2020

Rating, Analysis & Visualization

We rated all NHs from *1 to 5* based on *death rate* with 5 being the best. We built 9 machine learning models and found best models to predict death rate. We found most important features when predicting *death rate*: 'Total Resident Confirmed COVID-19 Cases Per 1,000 Residents', 'Staff Total COVID-19 Deaths', 'Staff Total Suspected COVID-19', 'Number of Payment Denials', 'Ownership Type'.

Feature Selection

We used *random forest* model to find the top features when predicting death rate. We visualize the effects of features by state and county and show how the *average rating score* can respond to the change in feature value. This could provide insights for customers what features to look at when selecting NHs. It will also help NHs managers to know how to lower death rate.

Evaluation

We performed the following 9 machine learning model to predict death rate and we can see that decision trees, random forest, SVM and KNN models achieved excellent result.

	KNN	EN	Lasso	Ridge	NB	DT	RF	SVM	NN
MSE	1.70	1.17	0.42	0.42	1.97	0.01	0.08	0.36	0.08
Accuracy (%)	58.5	22.19	62.75	62.30	58.40	98.83	99.16	87.87	95.07

Table 1. ML model performance in terms of predicting *death rate*

Survey

We sent out survey asking people for their opinion and advice for the platform. We received good feedback from the survery with 4.75 out of 5 satisfaction score. We also received recommendation for the areas that we need to improve on.

Choropleth Map

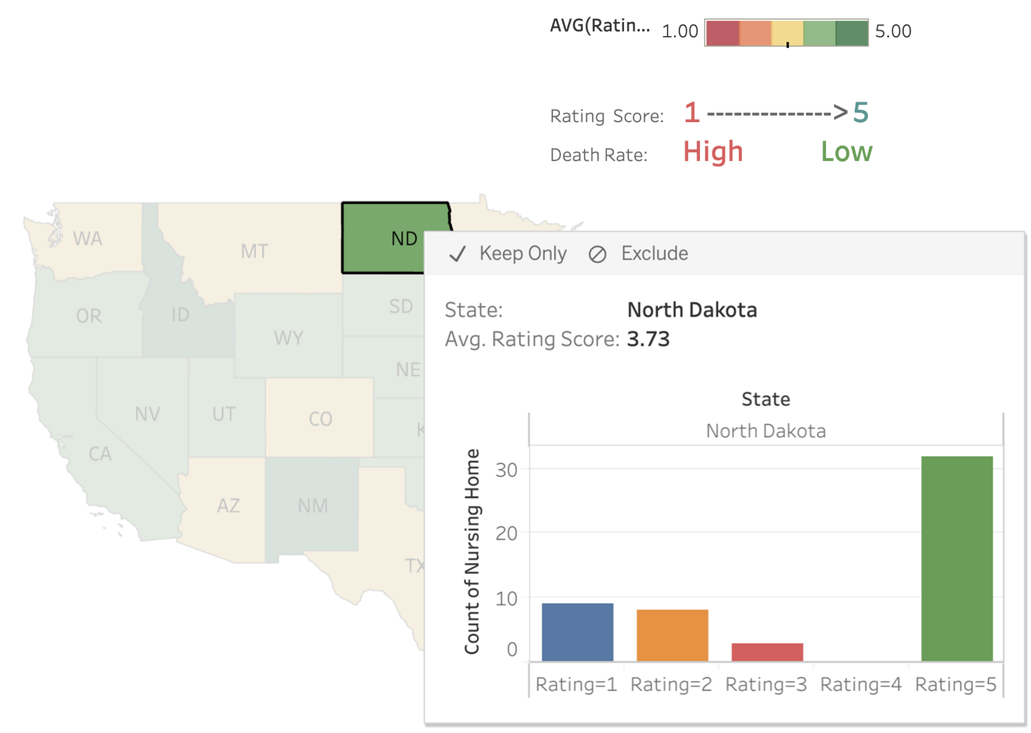

Figure 1. Choropleth map: nursing home performance

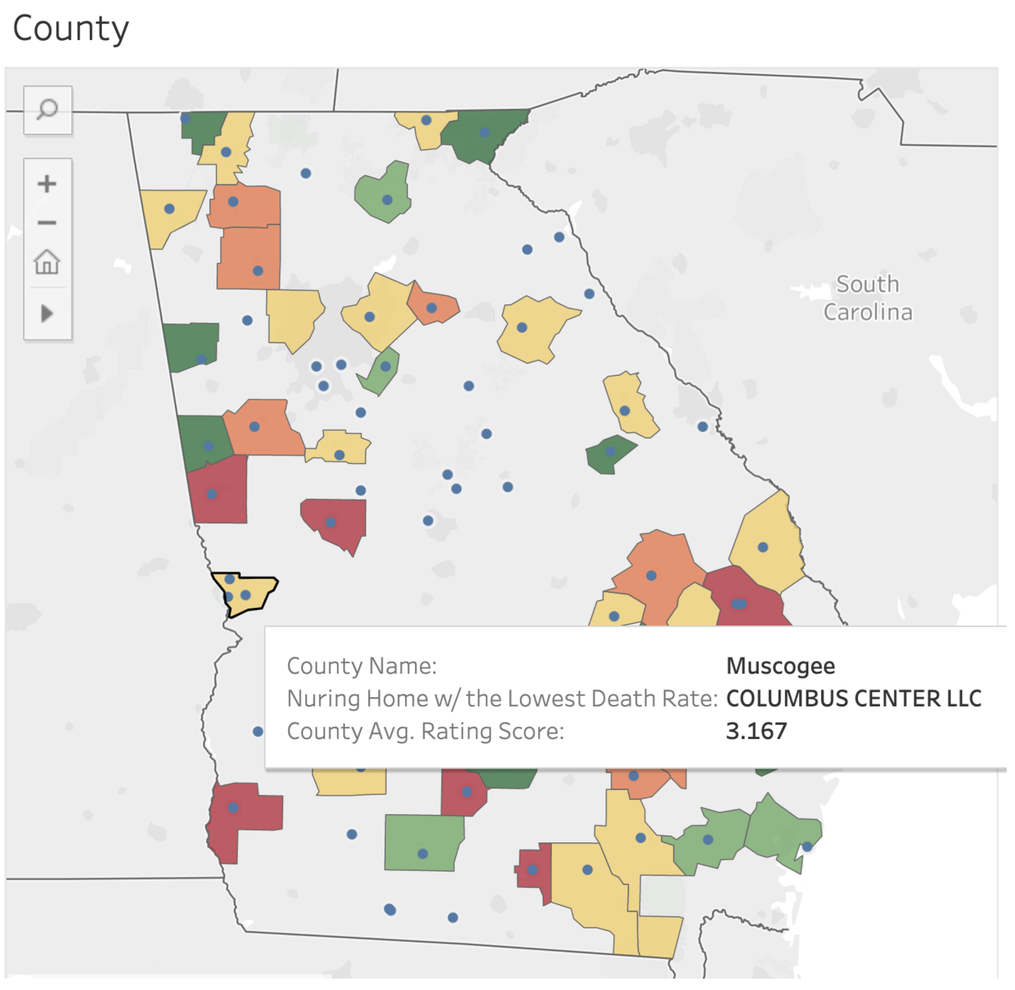

Figure 2. Choropleth map: Nursing home details

Nursing Home Name	Ownership	Provider Type	Provider Resides in Hospital
HERITAGE INN OF SANDER..	Non profit - Other	Medicare and Medicaid	False
ASFC,LLC	For profit - Corporation	Medicare and Medicaid	False
CALIFORNIA HOME FOR TH..	Non profit - Corporation	Medicare and Medicaid	False
COVENANT CARE CALIFOR..	For profit - Limited Liabilit..	Medicare and Medicaid	False

Figure 3: Nursing home information

Comparing Nursing Homes

We provide an easy-to-use tool to compare different nursing homes. By filtering State/County/Business names, one can directly see relevant information about nursing homes and compare nursing homes by specific measures. Here we use 'Staff Total Suspected COVID-19', Total Resident Confirmed COVID-19 (%)', 'Avg Number of Resident/Day and 'Registered Nurses Staffing Hrs'

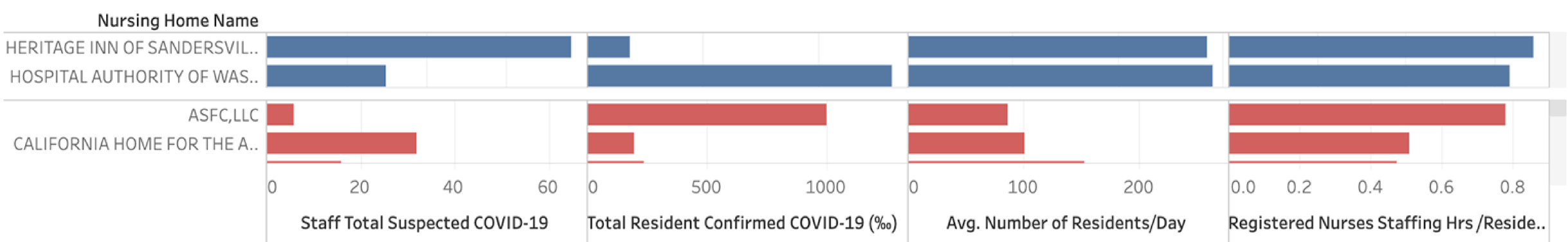

Figure 4. Comparing nursing home by specific features