

Firearm Violence Analysis and Modeling

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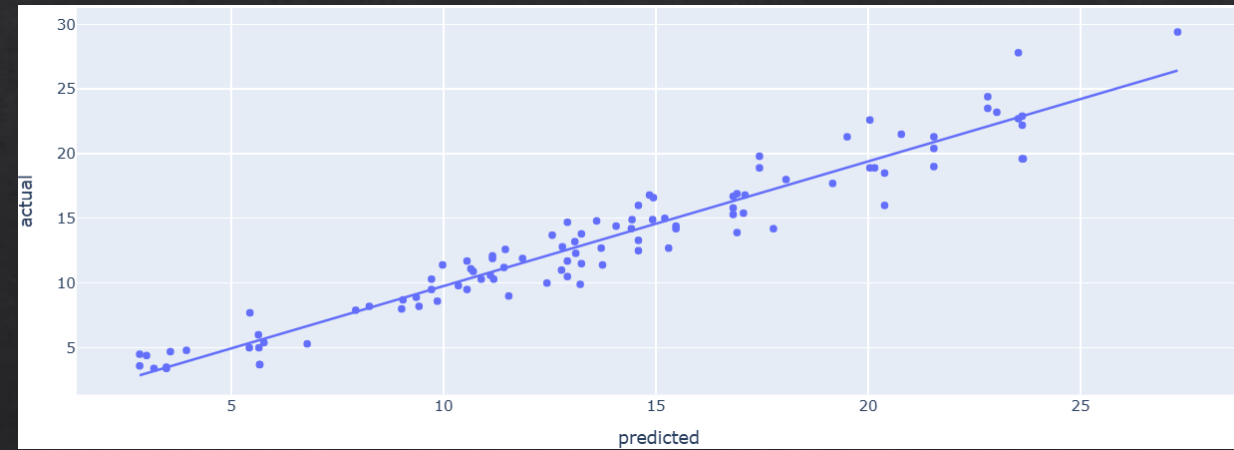
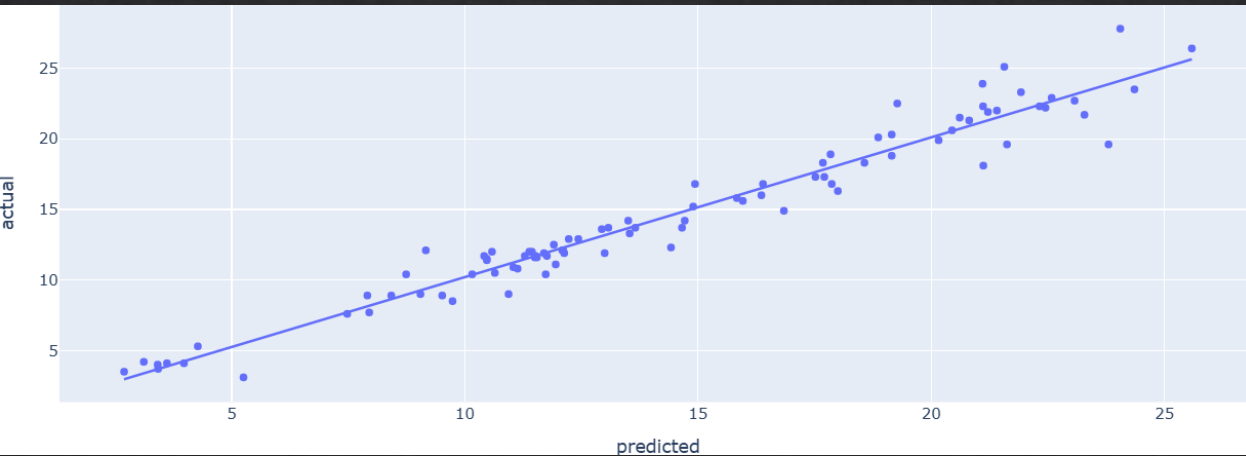
Robinson, Shiraz

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Research Question 1:

Can we predict firearm death rates based on gun law characteristics?

Basic Multi-Linear Regression Models

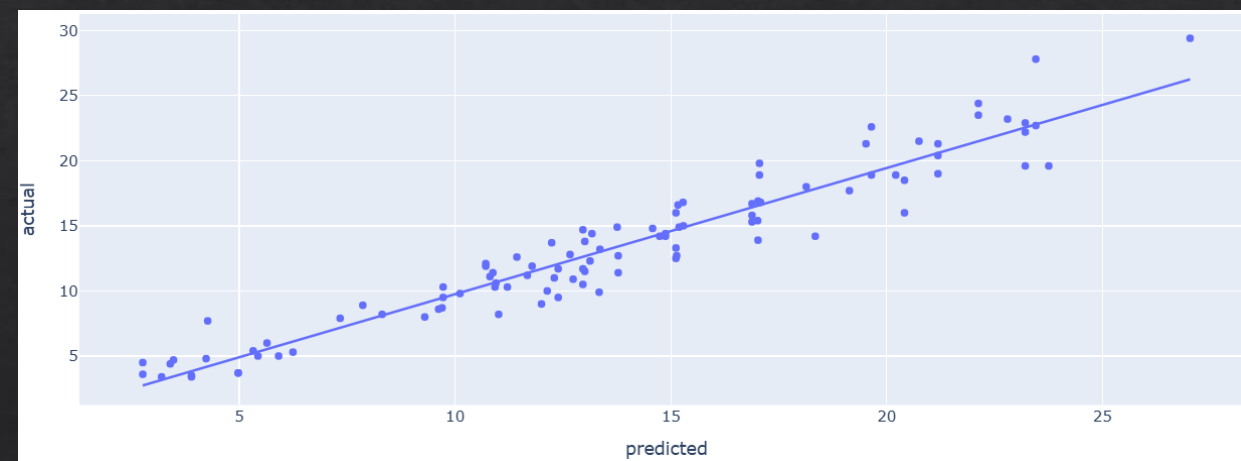
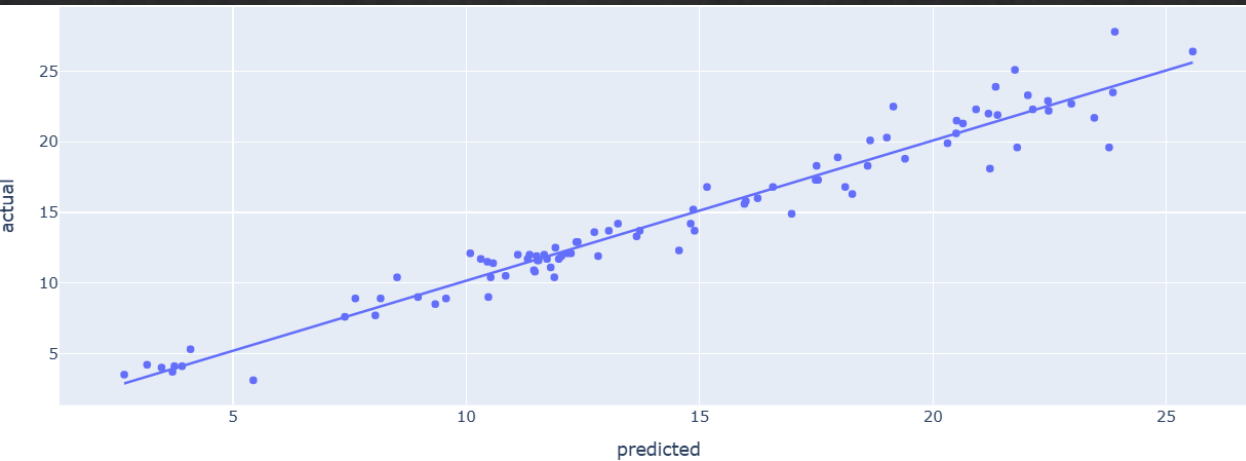


	Dataset 1	Dataset 2
Adj r^2	0.948	0.904
RMSE	1.277	1.598

Research Question 1c:

Can we predict firearm death rates based on gun law characteristics?

Ridge-Regressed Models

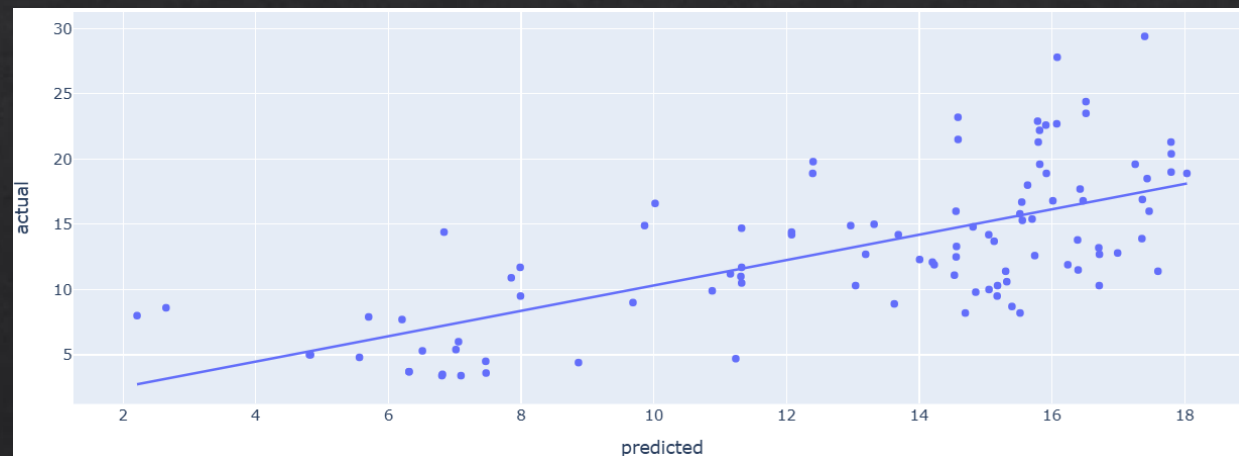
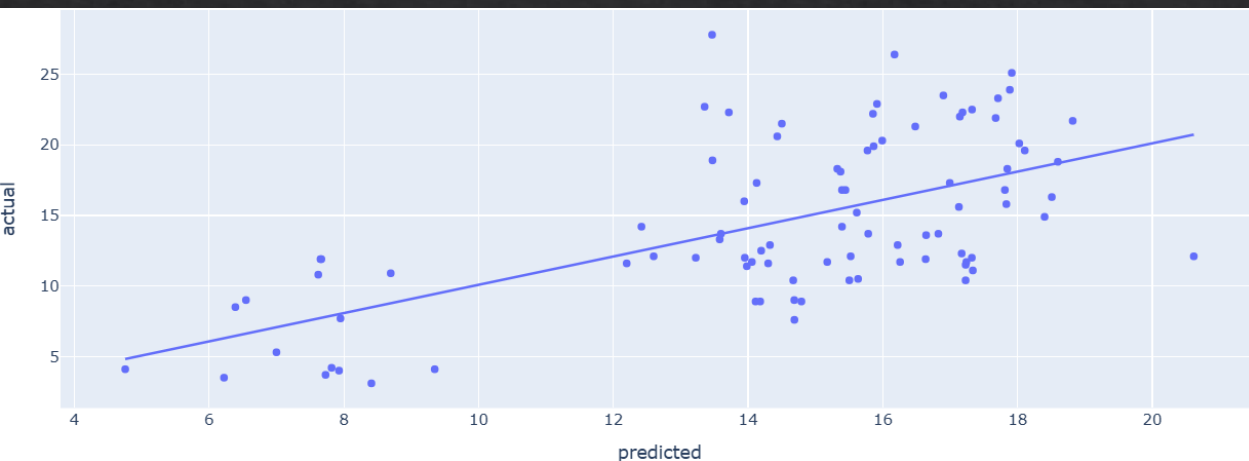


	Dataset 1	Dataset 2
Adj r^2	0.938	0.893
RMSE	1.280	1.689

Research Question 1c:

Can we predict firearm death rates based on gun law characteristics?

Principal Component Model

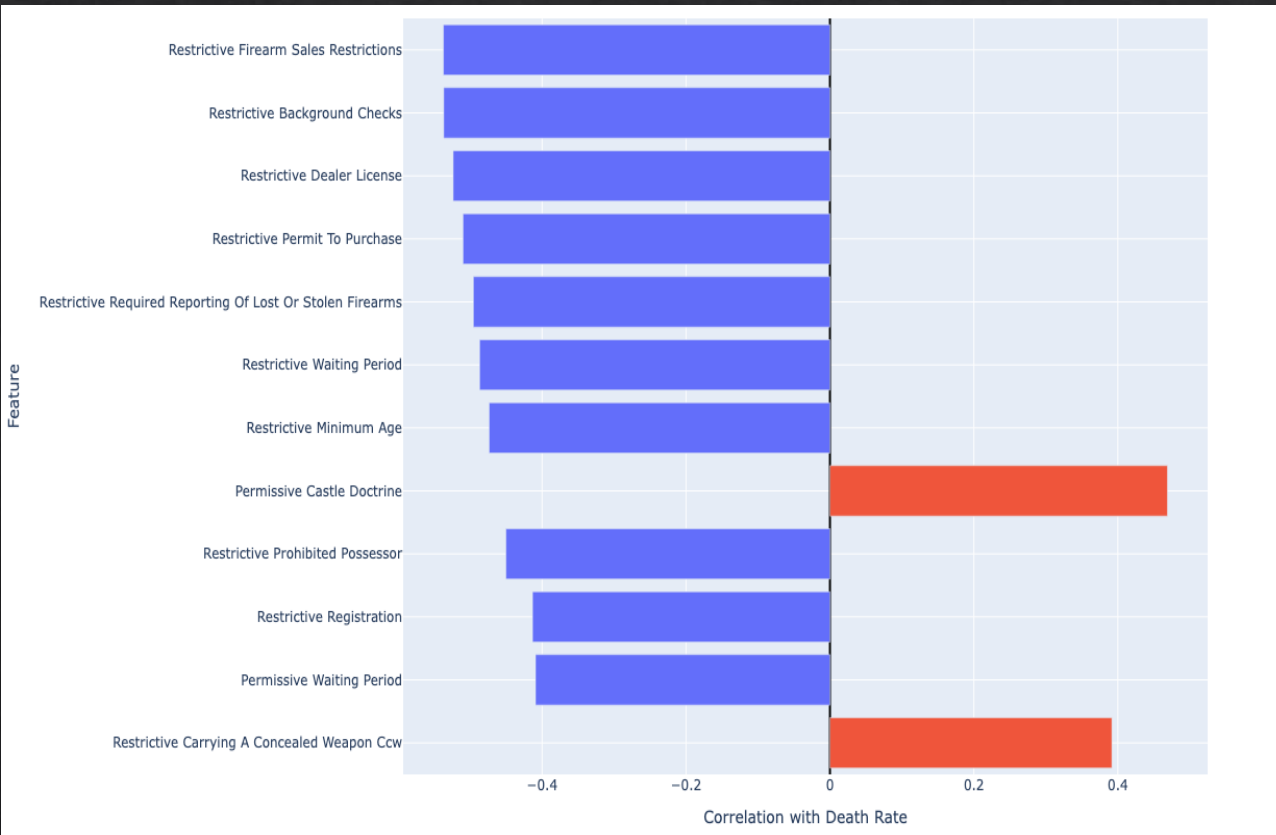


	Dataset 1	Dataset 2
Adj r^2	-1.234	-1.689
RMSE	4.602	4.280

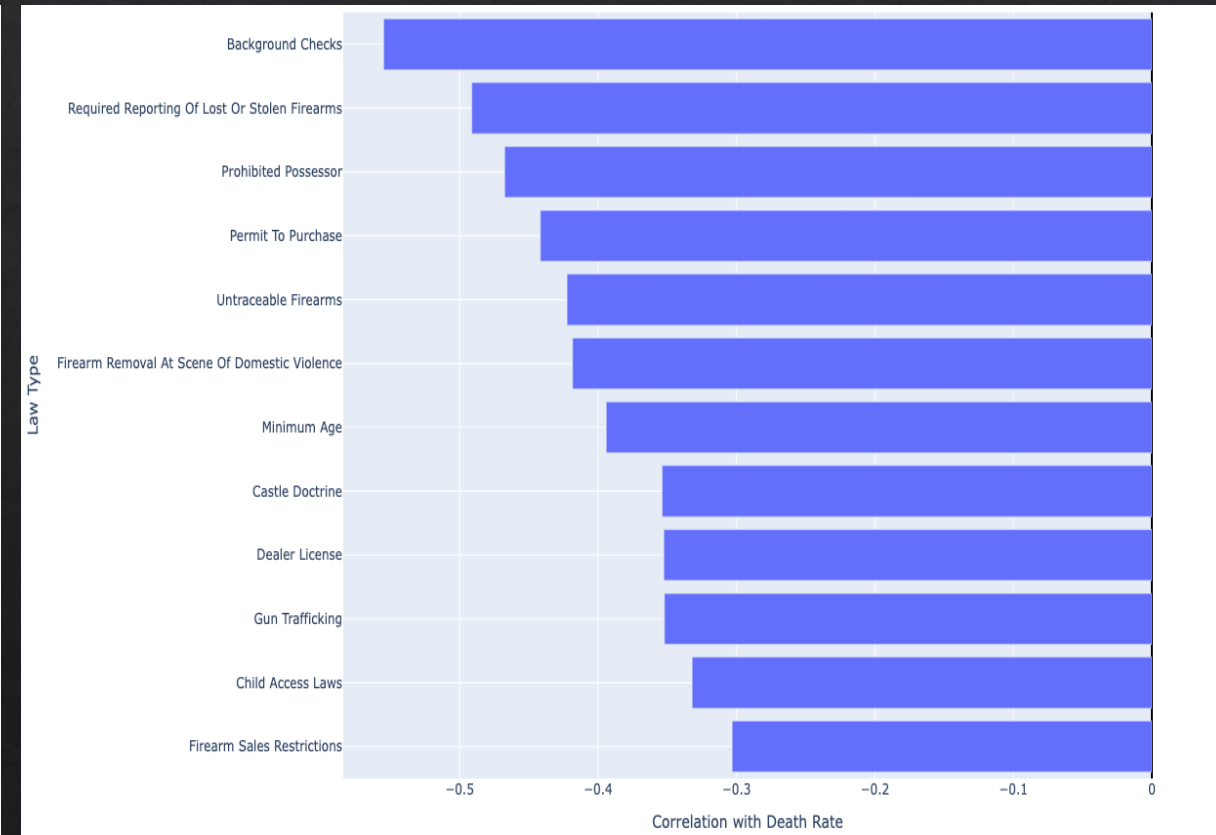
Research Question 2:

Which specific law types are most strongly associated with death rates?

Correlation of Features to Firearm Death Rates



Correlation of Law Strengths to Firearm Death Rates



Research Question 3:

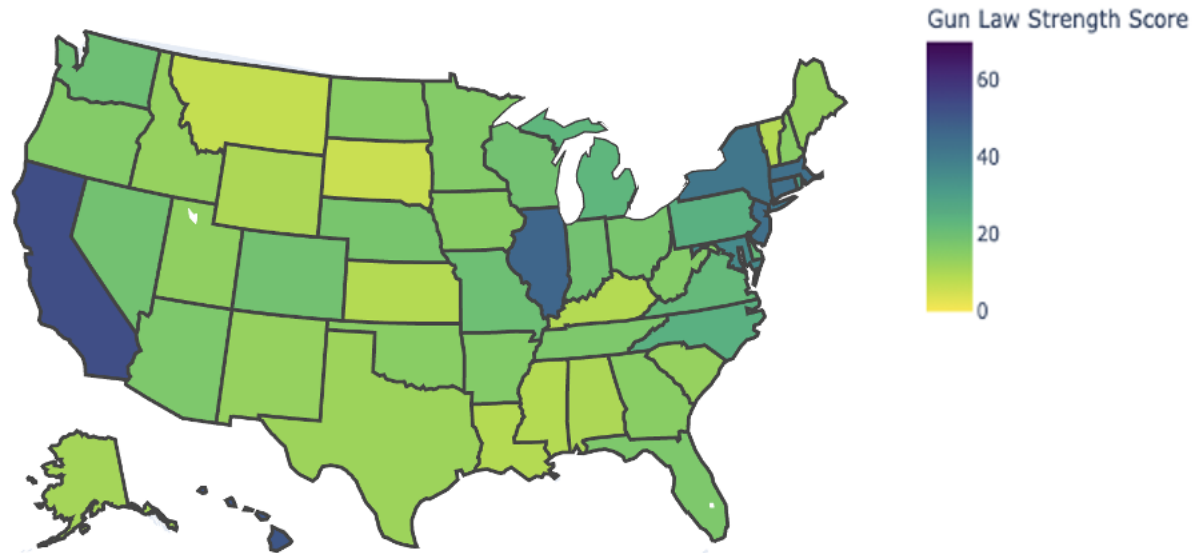
Can we identify distinct groups of states based on gun law profiles?

- ◆ Methods: K-Means (k=3), Hierarchical Clustering, PCA visualization.
- ◆ Key Findings:
 - ◆ Three clusters emerge: Most Restrictive, Moderately Restrictive, Least Restrictive.
 - ◆ Strong alignment between law strength and mortality rates.
 - ◆ PCA shows clear separation; 45.6% variance explained.
 - ◆ Interpretation: U.S. gun policy landscape is tri-modal, not continuous.
 - ◆ Validation: KNN & MLP classifiers achieve 75% accuracy in predicting cluster membership.

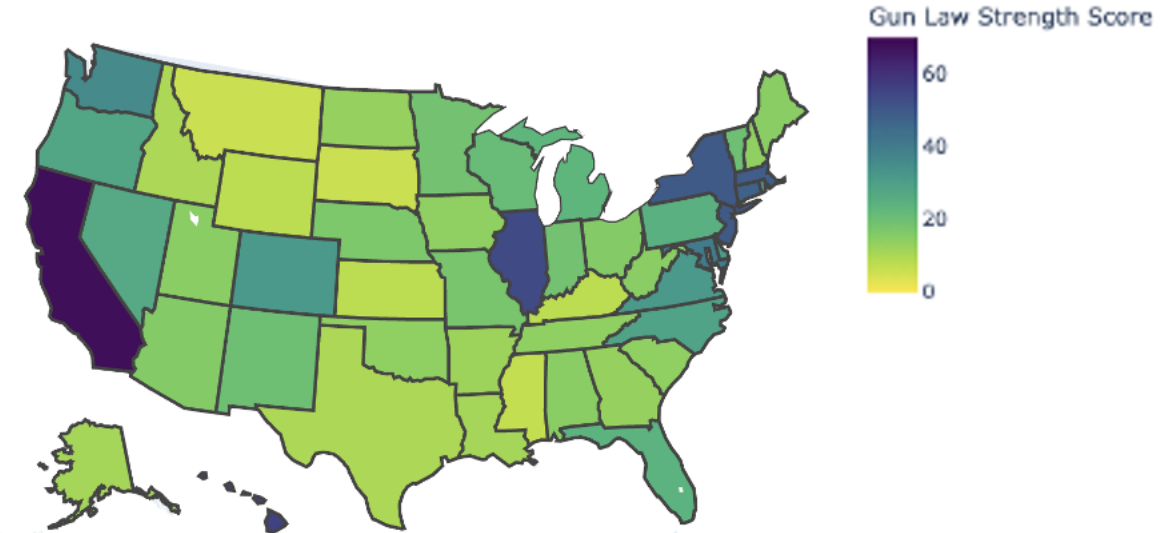
Research Question 4a:

Temporal Trends of Gun Law Strength

Gun Law Strength by State Over Time (2014–2023)



Gun Law Strength by State Over Time (2014–2023)

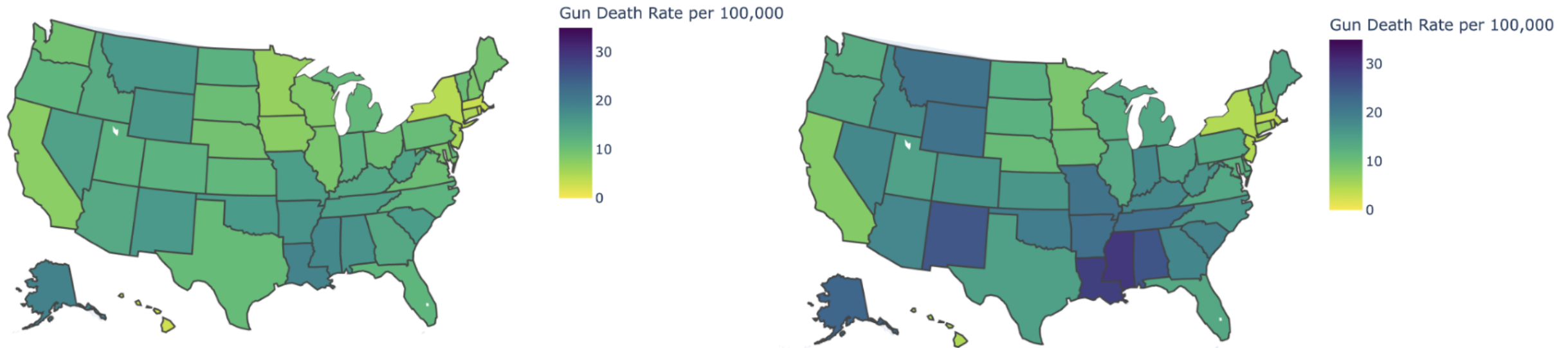


In this comparison, California, Illinois, New York, Massachusetts, Rhode Island, New Jersey, and Hawaii have consistently implemented restrictive gun laws between 2014 and 2023, with California having the most restrictive laws. On the contrary, South Dakota and Montana have consistently had permissive laws during that time.

Research Question 4b:

Temporal Trends of Gun Death Rate (per 100k)

Gun Death Rate by State Over Time (2014–2023)



In this comparison, despite not having the strongest laws over time, New York and Massachusetts have consistently had the lowest gun death rate for this period of time, while the highest has been in Mississippi, followed by Louisiana and New Mexico.

Conclusions:

- ◇ Complex stochastic process, difficult to predict with deterministic methods
- ◇ There are correlations and indications of a relationship between legislation passed and rates of gun deaths