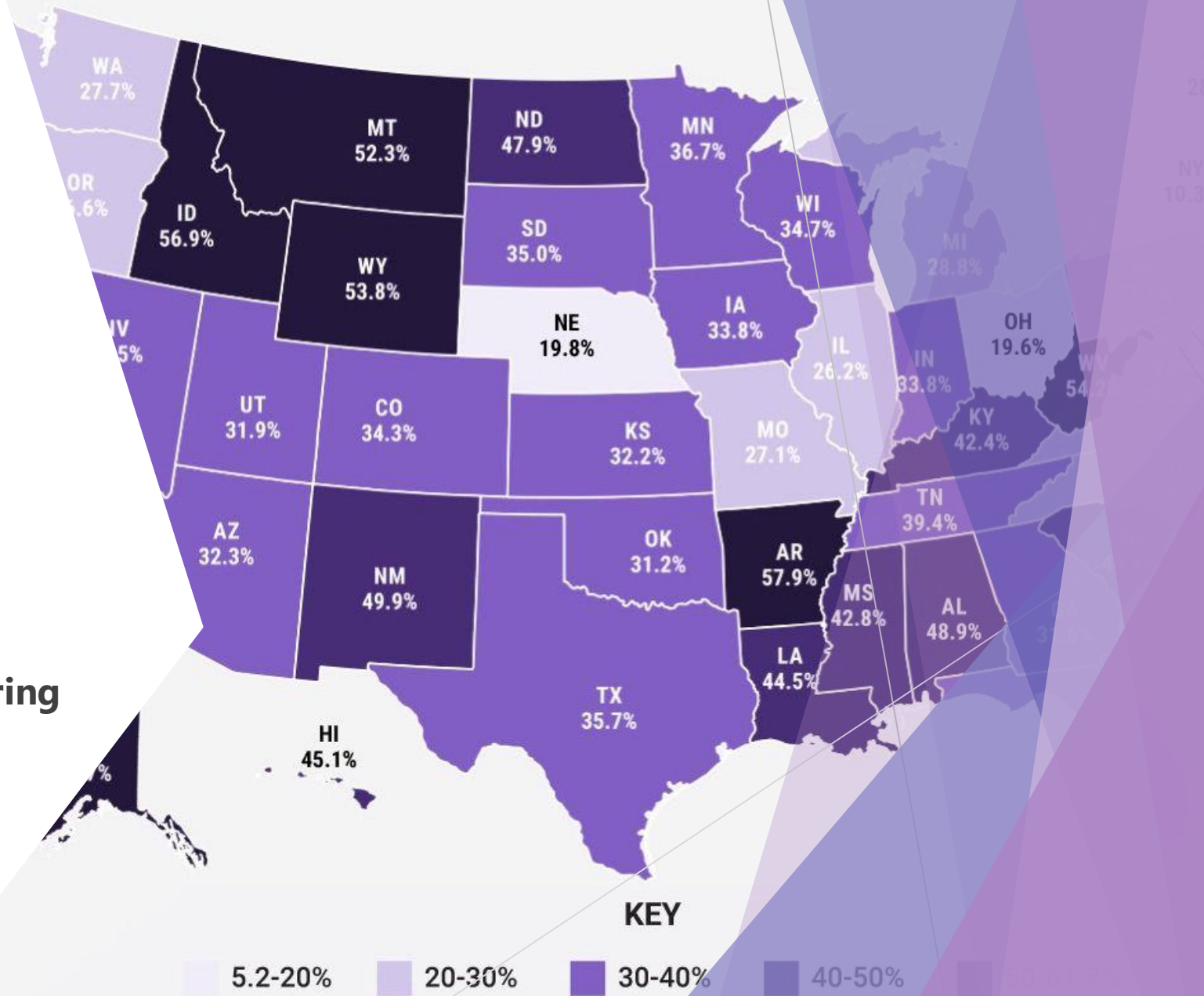


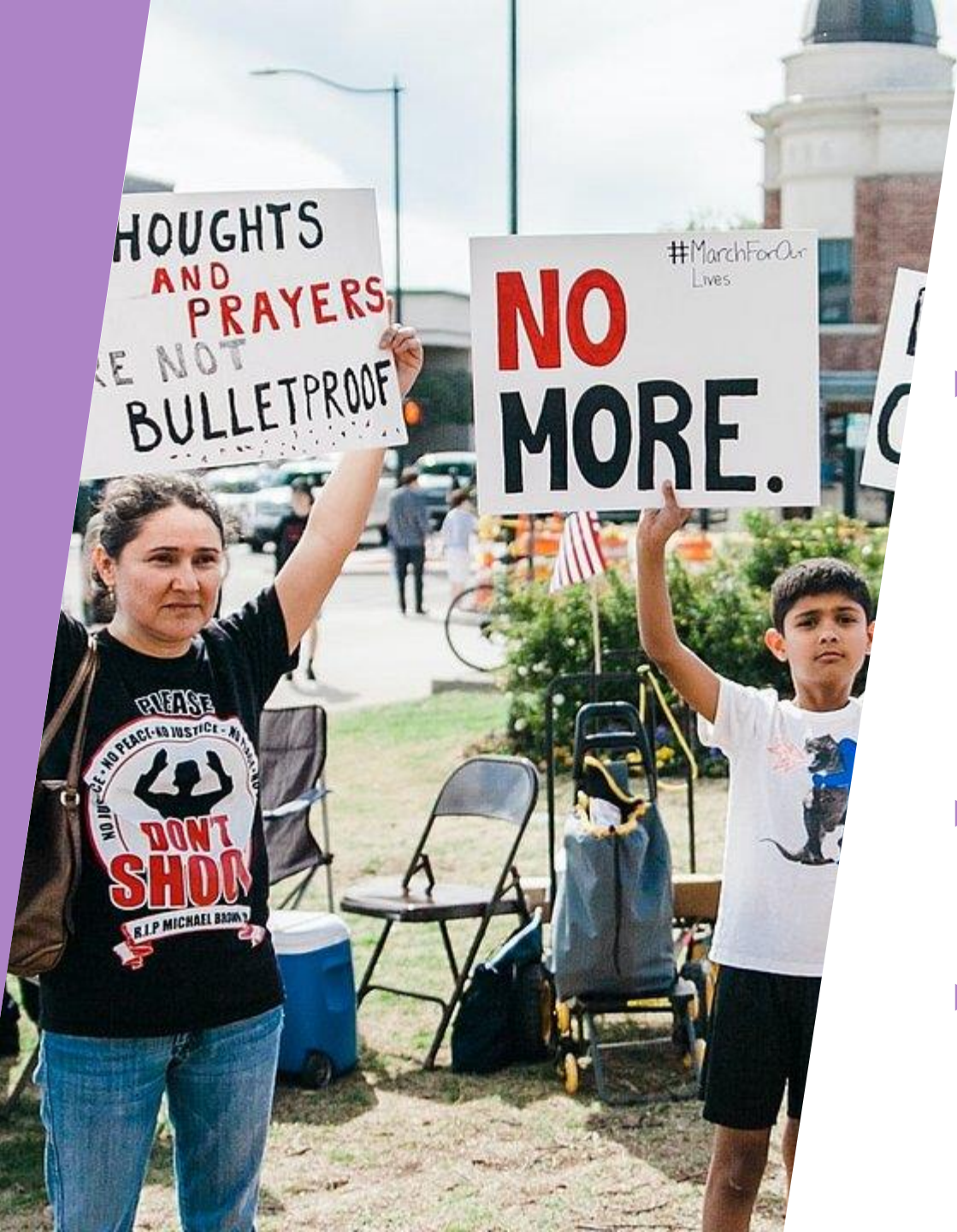
# Comparative Analysis of Firearm Ownership and Crime Rates Across U.S. States

► **Methods of Advanced Data Engineering**

► Fung, Ching Sze 2313 7788

## PERCENT WHO OWN GUNS





# Motivation

- ▶ Firearm ownership is a highly controversial topic in the U.S
  - ▶ Frequent reports of mass shootings and school gun violence.
  - ▶ The right to bear arms is protected by the U.S. Constitution, but firearm regulations vary significantly across states.
- ▶ **Strict states:**
  - ▶ Require thorough processes and extensive background checks.
- ▶ **Lenient states:**
  - ▶ Have fewer restrictions and easier access to firearms in background check





# Project Work

- ▶ This project analyzes the correlation between:
  - ▶ Regulation strictness/ Firearm ownership
  - ▶ Crime rates and death rate across various U.S. states
- ▶ Key Question:
  - ▶ “How do firearm ownership levels and the strictness of regulations correlate with crime rates across different U.S. states?”
    - ▶ Strict states (California, Massachusetts, New York)
    - ▶ Lenient states (Texas, Alaska, Wyoming)

# Datasets

## 1. FBI NICS Firearm Background Checks

- **Source:** National Instant Criminal Background Check System
- **Year:** 1998 - 2023
- MIT License
- **Key Columns:** year, state, permit, hand gun, long gun, multiple...
- **Purpose:** Provides insights into the strictness of firearm regulations across different states.

## 2. Firearm Mortality by State

- **Source:** Centers for Disease Control and Prevention
- **Year:** 2014 - 2022
- Licensed under Section 308(d) of the Public Health Service Act and CIPSEA
- **Key Columns:** year, state, rate, death...
- **Purpose:** Offers firearm mortality statistics across U.S. states.

## 3. FBI Crime Data

- **Source:** FBI's Centers for Crime Data Explorer
- **Year:** 1979 - 2022
- Available under the FBI's FOIA Library.
- **Key Columns:** population, violent crime, homicide...
- **Purpose:** Provides insights into crime rates and contributing factors across different states.

## Data Sources

1. FBI NICS Firearm Background Checks

2. Firearm Mortality by State

3. FBI Crime Data



# ETL Pipeline



1

Using the Kaggle API to download and extract the dataset.



2

Using `Selenium` to fetch the dataset from the URLs.



3

The downloads are split across multiple parts on the website  
→ data is downloaded directly

## Extraction

The process of retrieving specific data from a larger dataset or source.

**Clean Data:** Filter data to only six specific U.S. states; remove irrelevant columns

**Convert and normalized Data:** Change the date format from "Month" to "Year", taking crimes and permits proportionally

**Merge Data:** Calculate the "total" since some columns were filtered out and the date format was changed; merge data from different sources

## Transformation

The process involves cleaning, converting, and enriching the extracted dataset.

## Output Data

ETL\_cleaned\_data.csv

ETL\_cleaned\_data.db



After transforming the datasets, they are loaded into an SQL database, making them accessible for future analysis.

## Load

The transformed data is loaded into a database or another storage system.

# Datasets (Pipeline output)

## 1. FBI NICS Firearm Background Checks

	year	state	permit	handgun	long_gun	multiple	totals
0	1998	alaska	4.0	1365.0	2555.0	61	3985
1	1998	california	5366.0	28641.0	33438.0	0	67445
2	1998	massachusetts	0.0	321.0	1116.0	6	1443
3	1998	new york	1068.0	1094.0	12513.0	12	14736
4	1998	texas	5324.0	23862.0	52248.0	963	82399
5	1998	wyoming	121.0	970.0	2352.0	43	3486

## 2. Firearm Mortality by State

	YEAR	STATE	RATE	DEATHS
0	2022	AK	22.4	164
1	2022	CA	8.6	3484
2	2022	MA	3.7	263
3	2022	NY	5.3	1044
4	2022	TX	15.3	4630
5	2022	WY	20.4	124

## 3. FBI Crime Data

	year	state_abbr	state_name	population	violent_crime	homicide	aggravated_assault	property_crime	totals
0	1979	AK	alaska	406000	1994	54	1203	23193	26444
1	1979	CA	california	22696000	184087	2952	93129	1511021	1791189
2	1979	MA	massachusetts	5769000	30650	212	17286	310756	358904
3	1979	NY	new york	17649000	161906	2092	60949	933234	1158181
4	1979	TX	texas	13385000	67988	2235	34043	725109	829375
5	1979	WY	wyoming	450000	1579	41	1224	20129	22973

Combined Data from

	year	state	population	permit_totals	permit_per_lk	crimes_totals	crimes_per_lk	mortality_rate
0	2014	alaska	737046	87623	118.884032	28302	38.399232	19.2
1	2014	california	38792291	1474616	38.013120	1194460	30.791169	7.4
2	2014	massachusetts	6755124	179344	26.549328	170580	25.251942	3.2
3	2014	new york	19748858	365427	18.503703	460996	23.342919	4.2
4	2014	texas	26979078	1465992	54.338106	990280	36.705480	10.7
5	2014	wyoming	584304	63063	107.928407	13534	23.162600	16.2

# Data Analysis

## ► Correlation Analysis

- explores the correlation between firearm ownership permit grants, firearm-related mortality rates, and crimes

## Firearm permit vs. Firearm-Related Crimes/ Mortality Rate

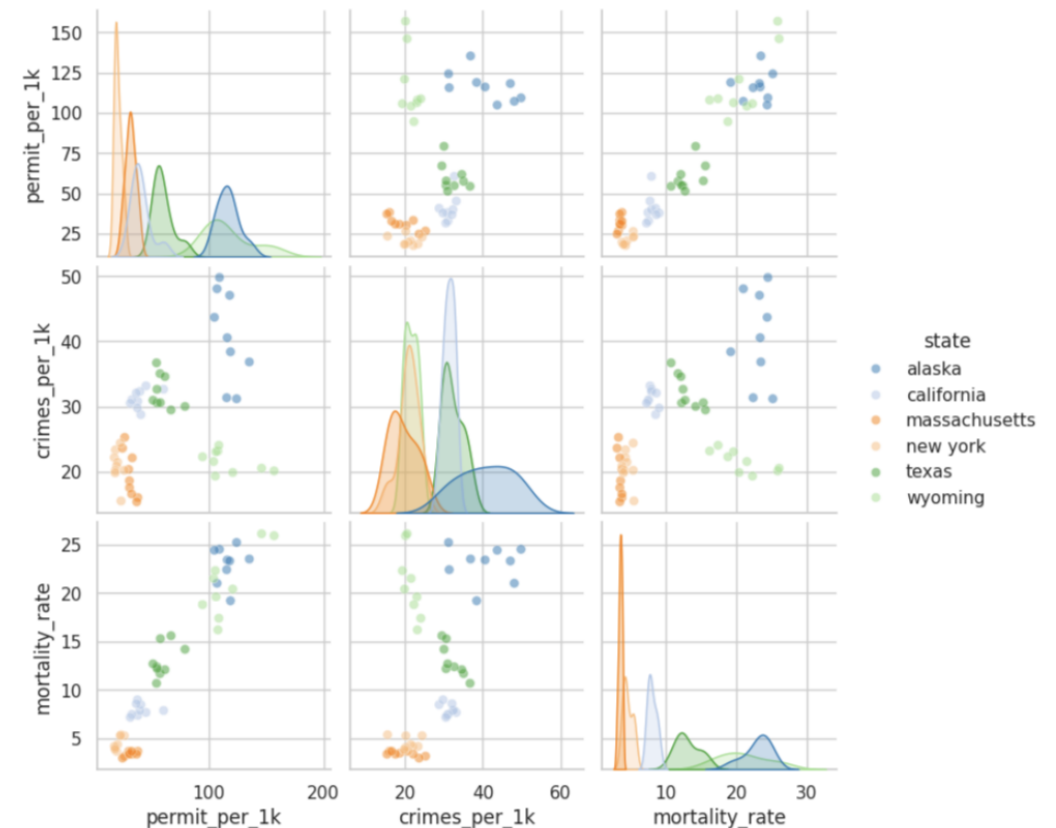
### ► Interpretation:

- Positive correlation: More permit, more crimes & mortality rate

1. Massachusetts, California, New York, and Texas generally offer fewer firearm permits

- correlates with lower mortality rates

2. States with higher firearm permits (Alaska and Texas) show higher crime rates.





# Data Analysis

## ► Correlation Analysis

- explores the correlation between firearm ownership permit grants, firearm-related mortality rates, and crimes

### Firearm permit vs. Firearm-Related Crimes/ Mortality Rate

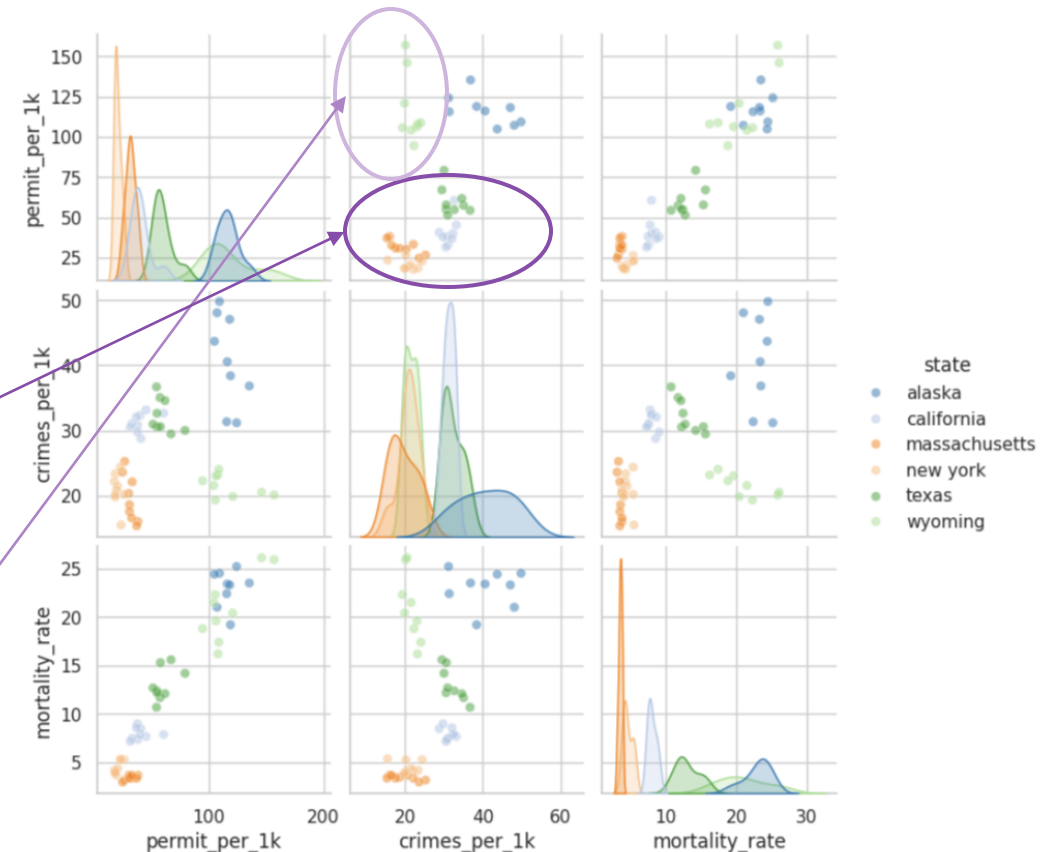
#### ► Interpretation:

- Positive correlation: More permit, more crimes & mortality rate

1. Massachusetts, California, New York, and Texas generally offer fewer firearm permits

- correlates with lower mortality rates

2. States with higher firearm permits (Alaska and Texas) show higher crime rates.

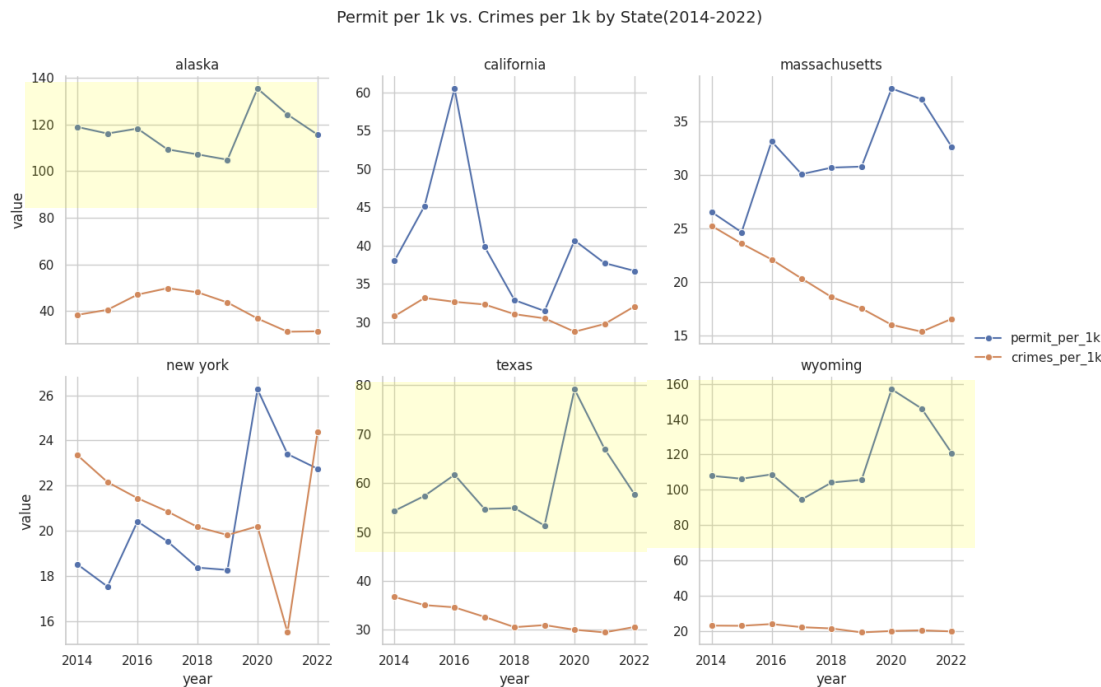




**Strict states:** California, Massachusetts, New York  
**Lenient states:** Texas, Alaska, Wyoming

# Data Analysis

## Firearm Permit Granted vs. Firearm-related Crimes



### ► Interpretation:

1. **Alaska, Wyoming, and Texas** show **higher firearm permit issuance rates**, with **Alaska and Wyoming** exceeding 100 permits per 1,000 citizens.
2. **Alaska, Texas, and California** have **higher crime rates** (30-40 per 1,000 citizens), while other states show lower crime rates (15-25 per 1,000 citizens).
3. **California, Massachusetts, and New York** reveal considerable variation.

**Strict states:** California, Massachusetts, New York  
**Lenient states:** Texas, Alaska, Wyoming

# Data Analysis

## Firearm Permit Granted vs. Firearm-related Crimes

Permit per 1k vs. Crimes per 1k by State(2014-2022)



### ► Interpretation:

1. **Alaska, Wyoming, and Texas** show **higher firearm permit issuance rates**, with **Alaska and Wyoming** exceeding 100 permits per 1,000 citizens.

► In contrast, **strict states** (California, Massachusetts, and New York) have **lower permit rates**, ranging from 20 to 40 per 1,000 citizens.

2. **Alaska, Texas, and California** have **higher crime rates** (30-40 per 1,000 citizens), while other states show lower crime rates (15-25 per 1,000 citizens).

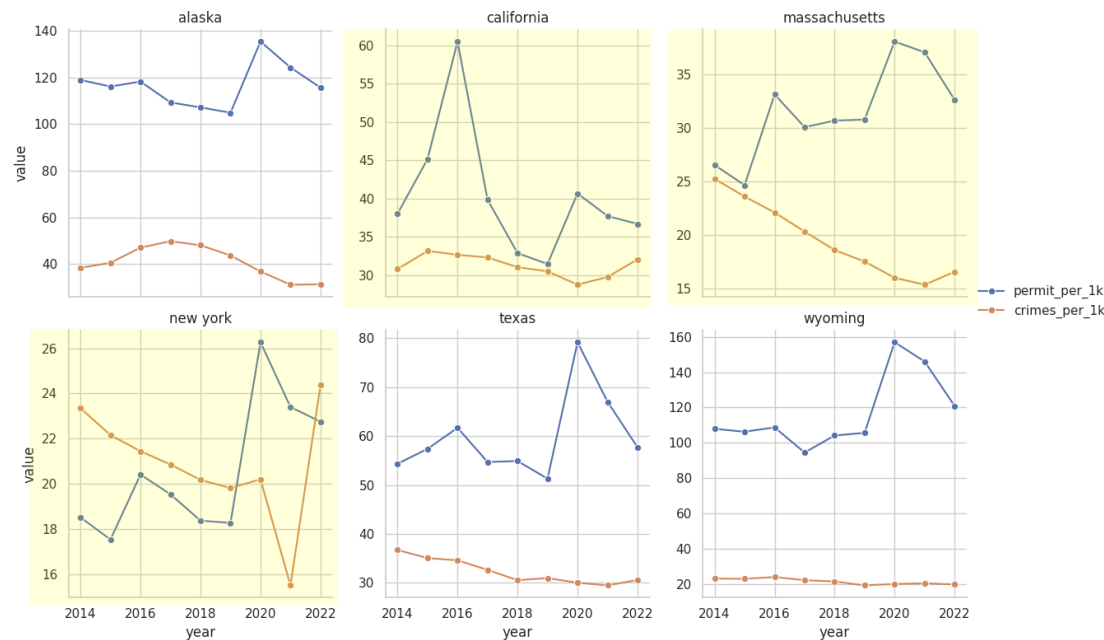
3. **California, Massachusetts, and New York** reveal considerable variation.

**Strict states:** California, Massachusetts, New York  
**Lenient states:** Texas, Alaska, Wyoming

# Data Analysis

## Firearm Permit Granted vs. Firearm-related Crimes

Permit per 1k vs. Crimes per 1k by State(2014-2022)

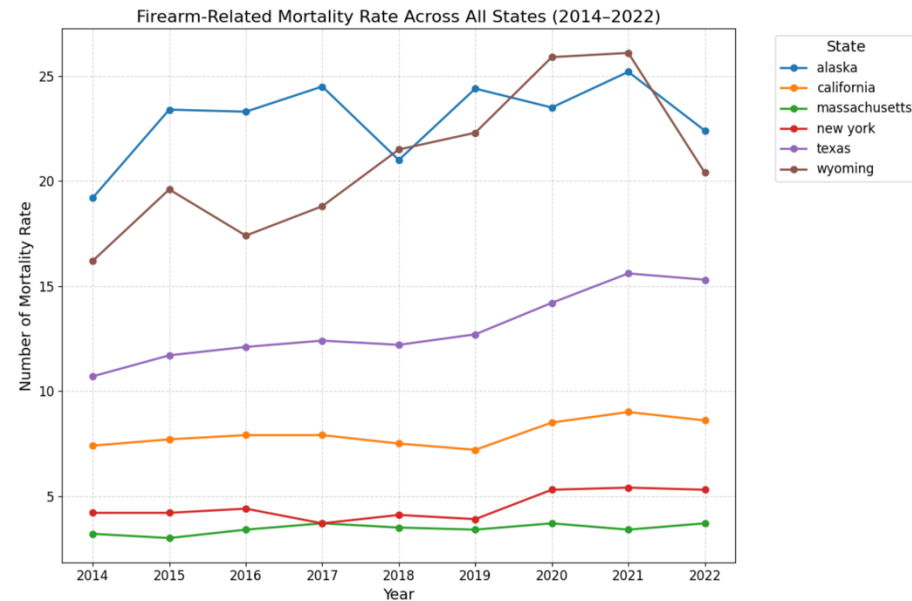
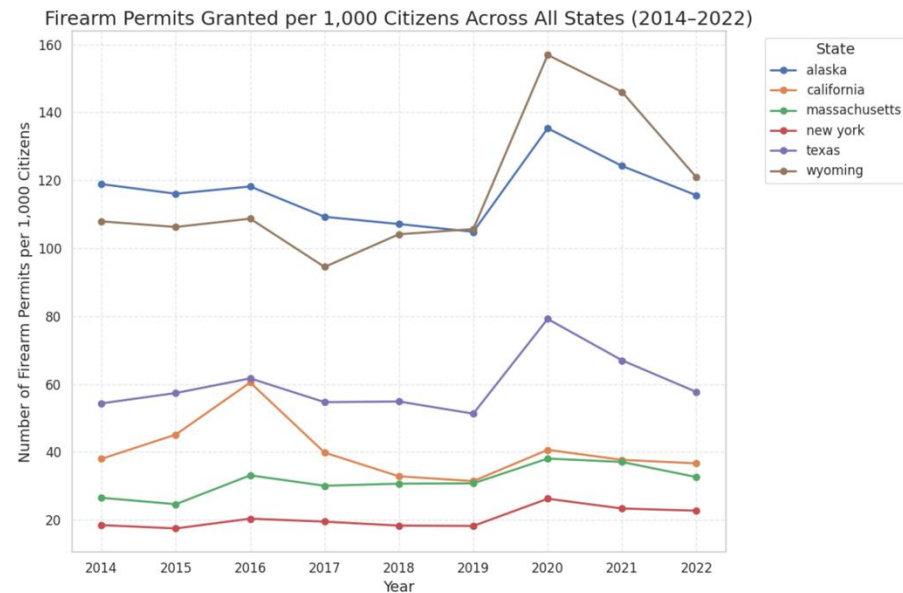


### ► Interpretation:

1. **Alaska, Wyoming, and Texas** show **higher firearm permit issuance rates**, with **Alaska and Wyoming** exceeding 100 permits per 1,000 citizens.  
► In contrast, **strict states** (California, Massachusetts, and New York) have **lower permit rates**, ranging from 20 to 40 per 1,000 citizens.
2. **Alaska, Texas, and California** have **higher crime rates** (30-40 per 1,000 citizens), while other states show lower crime rates (15-25 per 1,000 citizens).
3. **California, Massachusetts, and New York** reveal considerable variation.

# Data Analysis

## Firearm Permit Granted vs. Mortality Rate



### ► Interpretation:

- Firearm permit granted (from highest to lowest): Wyoming, Alaska, Texas, California, Massachusetts, and New York
- Firearm-related mortality rate(from highest to lowest): Wyoming, Alaska, Texas, California, New York, and Massachusetts
- The difference between highest(25%) and lowest mortality(3%) rate is **high**.



# Discussion and Conclusion

## ► Summary:

### ► **Strict states** like California, Massachusetts, and New York:

- citizens undergo rigorous background checks and require comprehensive knowledge to obtain firearm permits

→ generally **lower proportions of permits issued** and correspondingly **lower crime rates**

### ► **Lenient states** such as Wyoming, Alaska, and Texas:

- a larger proportion of citizens with firearm permits
- a strong correlation between less restrictive regulations and higher firearm-related mortality rates.

→ contributes to **higher firearm-related death rates**.

# Discussion and Conclusion

- ▶ **Limitation:**
  - ▶ limited in scope and does not account for various factors
    - ▶ economic development
    - ▶ education levels
    - ▶ cultural harmony etc.

Thank you!