Project proposal

Team 8

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0.1 1. Introduction

0.2 2. Data

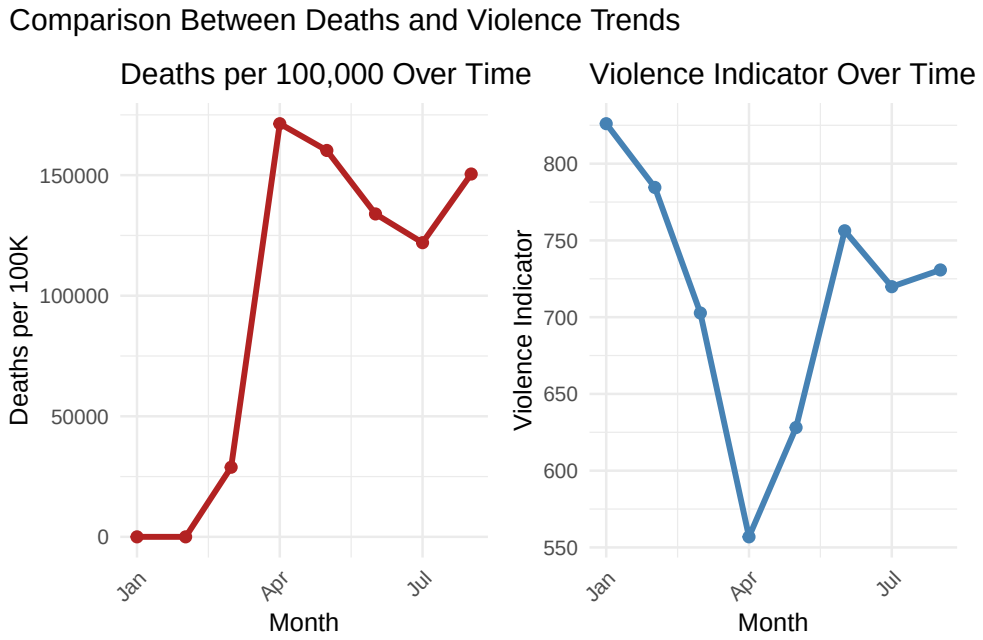
We are using four datasets to explore how the COVID-19 pandemic affected domestic violence trends across 25 countries. Our main dataset contains monthly reports of domestic violence. The other three datasets include lockdown policies, COVID-related deaths and unemployment rates. Some of our datasets of different measurments, we are looking to see trends in every country as its own so the measurment does not matter nor needs to be normalized. Also some of the datasets do not contain all the countries from our main dataset, but because we are working on 25 different countries and look for trends generally and not specify by country then it is acceptable to research some factors on a partly dataset of countries as long as we have more than 10-15 countries and their other factors exist and have a difference between them.

A full description of each dataset and the features we are using is provided in the README.md file in the `/data` folder and appears in the appendix of this document.

0.3 3. Preliminary results

In this analysis, we examine the relationship between trends in deaths per 100,000 people and reported violence incidents during the first months of the COVID-19 pandemic.

We plotted two time series graphs side-by-side: One shows the monthly deaths per 100,000 people The other shows the average violence indicator over the same period

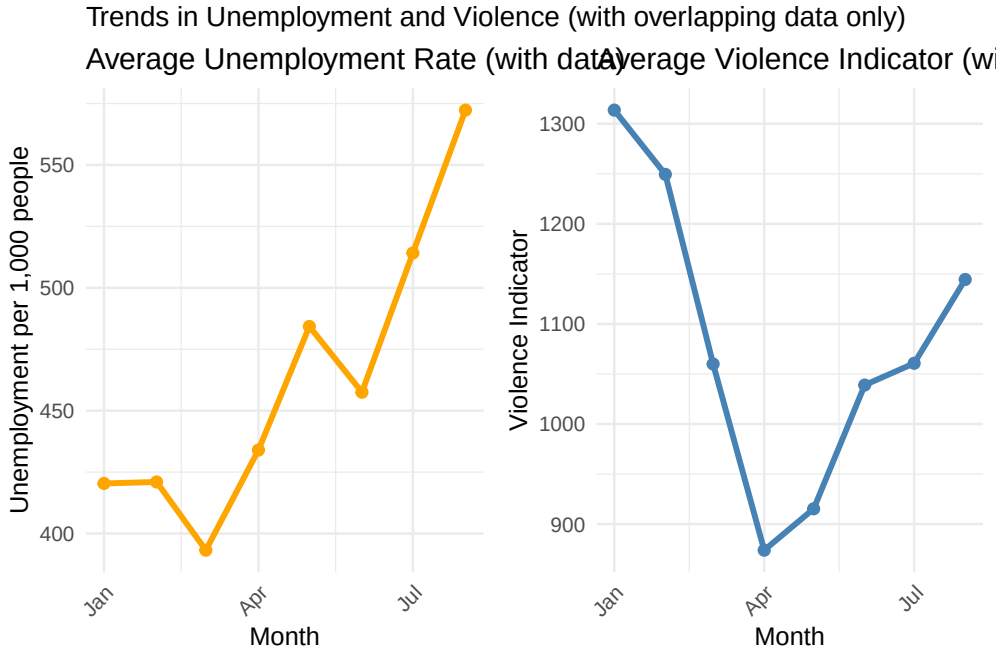


The graphs reveal that during the COVID-19 outbreak peak around April 2020, the number of deaths per 100,000 increased sharply. In contrast, the violence indicator shows a sharp decrease at the exact same time. After April, we observe an inverse pattern: while deaths begin to decline, violence starts to rise again.

These opposite trends suggest a potential negative association between mortality levels and violence during the pandemic — possibly reflecting factors such as lockdown severity, reduced social interaction, or underreporting of violence

This analysis examines the global trends in unemployment per 1000 people and violence incidents during the early phase of the COVID-19 pandemic

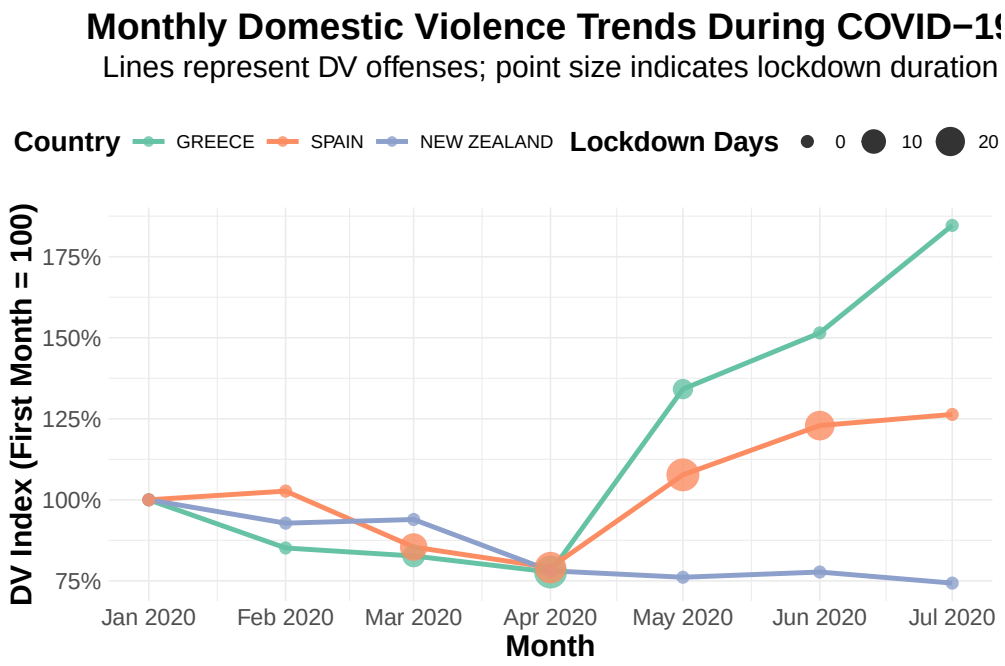
We present two side-by-side time series plots The left plot shows the average global unemployment rate per 1000 people The right plot shows the average global violence indicator over time



Although the rela-

tionship between the two variables is less clearly defined compared to previous analyses we still observe a notable shift around April 2020 when the COVID-19 pandemic began to peak globally During this time the unemployment rate begins a steady increase that continues in the following months In contrast the violence indicator reaches its lowest point in April followed by a gradual upward trend

This simultaneous change suggests that the early stages of the pandemic may have impacted both economic and social stability While the trends are not perfectly inversely correlated the timing of their shifts hints at a possible indirect connection between rising unemployment and increases in violence



In this graph we compare three countries that handled COVID-19 in a different way through national lockdowns, Spain which had serious and long lockdowns, Greece which had partial and short lockdowns and New Zealand which had no lockdowns during this time, although it is only three countries we can see the domestic violence rates trends are very different and we would like to continue our research along with the other factors to fully understand what might cause the rise or fall of domestic violence during the beginning of the pandemic.

0.4 4. Data analysis plan

Response (Y) Variable: Violence indicator: Our primary outcome measure representing reported domestic violence incidents

Explanatory (X) Variables: -COVID mortality rates: Monthly deaths per 100,000 people -Lockdown severity: Categorized levels of government restrictions -Unemployment rates: Monthly unemployment figures per 1,000 people

Comparison Groups We'll group countries across several dimensions: Geographic: Continental regions and economic development levels (high/middle/low-income) Policy Response: -Lockdown severity (high/medium/low restriction) -Policy timing (early vs delayed responders)

Temporal: Pandemic phases (pre-pandemic, first wave, intermediate, second wave) Seasonal periods to control for seasonal variations

Impact-Based:

Mortality impact groups Economic impact groups

Methods

-Data Visualization & Transformation Using time series plots and log transformations to visualize trends and address non-linear patterns in violence reporting.

-Multiple Linear Regression Analyzing how mortality, unemployment, and lockdown measures simultaneously affected violence indicators while controlling for multiple factors.

-Non-Linear Modeling Incorporating polynomial terms to capture potential non-linear relationships between pandemic duration and violence trends.

-Interaction Models Testing whether lockdown effects varied based on economic conditions using interaction terms in our regression models.

-Feature Engineering Creating derived variables including lagged variables, percent changes from baselines, and cumulative measures of lockdown duration.

-Model Evaluation Using adjusted R-squared, residual analysis, and visual diagnostics to identify effective models and prevent overfitting.

Expected Results We expect to find:

-Regional variations in violence patterns across continents -A "V-shaped" trend in high-restriction countries (initial decrease followed by increase) -Different patterns between first and second waves as countries adapted -Stronger lockdown-violence associations in countries with higher unemployment

These findings would support our hypothesis that pandemic factors influenced domestic violence in complex ways, moderated by economic conditions and varying across different types of countries and pandemic phases. Teamwork Division Data Preparation:

Team member 1: Clean datasets, handle missing values Team member 2: Create derived features, normalize variables

Statistical Analysis:

Team member 3: Conduct group comparisons (ANOVA, t-tests) Team member 4: Design visualization strategies

Modeling:

Team members 1 & 2: Implement regional and policy-specific models Team member 3: Create temporal models Team member 4: Coordinate model evaluation across groups

Report Preparation: All team members will collaborate on interpreting results with me leading the synthesis of findings across groups.

0.5 Appendix

0.5.1 Data README

```
---
output:
  pdf_document: default
  html_document: default
---
# Data Dictionary

## 1. covid_monthly_domesticviolence.xlsx
**Description**: this is a monthly count of domestic violence cases across 34 countries during the begi

**Columns:**
```

- ‘Region‘: self explenatory
- ‘Sub region‘: not-used
- ‘Country‘: country indicator
- ‘Indicator‘: the domestic violence indicator - sexual/physical, female/male victim
- ‘Oct_2019‘: monthly indicator (has numeric count per country per indicator)
- ‘Nov_2019‘: monthly indicator (has numeric count per country per indicator)
- ‘Dec_2019‘: monthly indicator (has numeric count per country per indicator)
- ‘Jan_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Feb_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Mar_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Apr_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘May_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Jun_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Jul_2020‘: monthly indicator (has numeric count per country per indicator)
- ‘Aug_2020‘: monthly indicator (has numeric count per country per indicator)

Structure (‘glimpse‘):
Rows: 129
Columns: 15
$ Region   <chr> "Europe", "Americas", "Europe", "Europe", "Europe", "Europe", "Americas", "Amer...
$ ‘Sub region‘ <chr> "Southern Europe", "Latin America and the Caribbean", "Southern Europe", "South...
$ Country   <chr> "ALBANIA", "ANTIGUA AND BARBUDA", "BOSNIA AND HERZEGOVINA", "BOSNIA AND HERZEGO...
$ Indicator   <chr> "Sexual violence or physical assault by IPFM* (domestic violence): Total numbe...
$ Oct_2019   <dbl> 112, 5, 109, 30, 3, 27, 9903, 1224, 3888, 0, 1, 0, 1, NA, NA, NA, NA, NA, 176, ...
$ Nov_2019   <dbl> 81, 5, 104, 32, 2, 30, 9886, 1193, 3983, 0, 1, 0, 0, NA, NA, NA, NA, NA, 155, 2...
$ Dec_2019   <dbl> 113, 1, 131, 34, 3, 31, 10883, 1304, 4224, 0, 1, 0, 0, NA, NA, NA, NA, NA, 184,...
$ Jan_2020   <dbl> 111, 6, 73, 38, 5, 33, 11178, 1222, 4294, 0, 2, 0, 0, NA, NA, NA, NA, NA, 190, ...
$ Feb_2020   <dbl> 90, 6, 95, 57, 2, 55, 9899, 1124, 3680, 0, 0, 0, 2, NA, NA, NA, NA, NA, 222, 5,...
$ Mar_2020   <dbl> 90, 7, 88, 49, 5, 44, 9578, 1035, 3626, 0, 1, 0, 2, NA, NA, NA, NA, NA, 209, 1,...
$ Apr_2020   <dbl> 96, NA, 86, 40, 5, 35, 7776, 878, 2889, 0, 1, 0, 0, 7617, 0, 9, 1716, 538, 190,...
$ May_2020   <dbl> 127, NA, NA, NA, NA, NA, NA, NA, NA, 0, 0, 0, 0, 9674, 0, 3, 2216, 575, 222, 0,...
$ Jun_2020   <dbl> 159, NA, NA, NA, NA, NA, NA, NA, NA, 0, 3, 0, 1, 7690, 0, 5, 1703, 443, 292, 0,...
$ Jul_2020   <dbl> 158, NA, NA, NA, NA, NA, NA, NA, NA, 0, 2, 0, 0, 8167, 1, 1, 1985, 512, 250, 0,...
$ Aug_2020   <dbl> 174, NA, NA, NA, NA, NA, NA, NA, NA, 0, 5, 1, 2, 7289, 0, 2, 1684, 296, 295, 0,...

Summary Statistics (‘summary‘):
```
    Region           Sub region          Country           Indicator           Oct_2019      
 Length:129         Length:129         Length:129         Length:129         Min.   :   0.0  
 Class :character   Class :character   Class :character   Class :character   1st Qu.:   3.0  
 Mode  :character   Mode  :character   Mode  :character   Mode  :character   Median :  31.0  
                                                                             Mean   : 554.7  
                                                                             3rd Qu.: 251.0  
                                                                             Max.   :9903.0  
                                                                             NA's   :24      
    Nov_2019          Dec_2019          Jan_2020          Feb_2020          Mar_2020      
 Min.   :    0.0   Min.   :    0.0   Min.   :    0.00   Min.   :    0.0   Min.   :   0.0  
 1st Qu.:    3.0   1st Qu.:    3.0   1st Qu.:    2.75   1st Qu.:    2.0   1st Qu.:   3.0  
 Median :   32.0   Median :   49.5   Median :   34.00   Median :   35.0   Median :  33.0  
 Mean   :  515.5   Mean   :  585.0   Mean   :  568.65   Mean   :  540.0   Mean   : 467.5  
 3rd Qu.:  269.0   3rd Qu.:  372.2   3rd Qu.:  307.75   3rd Qu.:  288.2   3rd Qu.: 218.0  
 Max.   :10508.0   Max.   :11642.0   Max.   :13018.00   Max.   :12409.0   Max.   :9750.0  
 NA's   :16        NA's   :15        NA's   :17         NA's   :17        NA's   :12      
    Apr_2020          May_2020          Jun_2020          Jul_2020          Aug_2020      
 Min.   :   0.0   Min.   :   0.00   Min.   :   0.0   Min.   :   0.0   Min.   :   0.00  
```

```
 1st Qu.:   2.0   1st Qu.:   3.25   1st Qu.:   5.0   1st Qu.:   2.0   1st Qu.:   2.75
 Median :  35.0   Median :  51.00   Median :  54.0   Median :  49.0   Median :  29.00
 Mean   : 444.7   Mean   : 572.08   Mean   : 610.2   Mean   : 611.7   Mean   : 604.20
 3rd Qu.: 216.5   3rd Qu.: 360.75   3rd Qu.: 331.0   3rd Qu.: 342.2   3rd Qu.: 295.25
 Max.   :7776.0   Max.   :9674.00   Max.   :9122.0   Max.   :9377.0   Max.   :9056.00
 NA's   :11       NA's   :43        NA's   :40       NA's   :43       NA's   :53
```

---

2. death_rates.csv
Description: a 3 column dataset that will tell us the daily and by that monthly deaths from COVID-19

Columns:
- ‘Entity‘: the country indicator
- ‘Day‘: daily date from the start of 2020
- ‘Daily new confirmed deaths due to COVID-19 per million people (rolling 7-day average, right-aligned)

Structure (‘glimpse‘):
```
Rows: 480,085
Columns: 3
$ Entity
$ Day
$ ‘Daily new confirmed deaths due to COVID-19 per million people (rolling 7-day average, right-aligned)
```

Summary Statistics (‘summary‘):
```
    Entity              Day
 Length:480085      Length:480085
 Class :character   Class :character
 Mode  :character   Mode  :character


 Daily new confirmed deaths due to COVID-19 per million people (rolling 7-day average, right-aligned)
 Min.   :  0.0000
 1st Qu.:  0.0000
 Median :  0.0000
 Mean   :  0.6629
 3rd Qu.:  0.2464
 Max.   :129.2137
```

---

3. coronanet_release_Croatia.csv
Description: an example dataset of the policies in this country,
we will take the lockdowns and interpert from that,
we have a dataset like this for each of our countries (we are explaining only some columns)

Columns:
- ‘description‘: the full description of the policy/lockdown for our use and filtering
- ‘date_announced‘: when was it announced
- ‘date_start‘: when did it start
- ‘date_end‘: when did it end

- ‘date_end_spec‘: not used or important
- ‘country‘: country indicator
- ‘init_country_level‘: is it national, regional or provencial
- ‘domestic_policy‘: is it domestic or worldwide
- ‘type‘: specified if its lockdown or something else
- ‘target_who_what‘: is it for all residents or just visitors or based on age
- ‘compliance‘: mandatory/voluntary

Structure (‘glimpse‘):
Rows: 1,076
Columns: 63
$ description <chr> "September 14, 2020: With Bulletin N. 262, the Italian Ministry of He...
$ date_announced <date> 2020-09-14, 2020-04-07, 2020-02-25, 2020-03-11, 2020-03-11, 2020-03-...
$ date_start <date> 2020-09-14, 2020-04-07, 2020-02-25, 2020-03-13, 2020-03-13, 2020-03-...
$ date_end <date> 2020-09-15, NA, 2020-02-25, 2020-03-30, 2020-03-30, 2020-03-30, 2020...
$ date_end_spec <chr> "The policy has a clear end date", "The policy's end date is unknown ...
$ country <chr> "Albania,Andorra,Armenia,Austria,Azerbaijan,Belarus,Belgium,Bosnia an...
$ init_country_level <chr> "National", "National", "National", "National", "National", "National...
$ domestic_policy <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...
$ type <chr> "New Task Force, Bureau or Administrative Configuration", "New Task F...
$ target_who_what <chr> "All Residents (Citizen Residents + Foreign Residents)", "All Residen...
$ compliance <chr> "Mandatory (Unspecified/Implied)", "Mandatory (Unspecified/Implied)",...

---

4. UNE_TUNE_SEX_AGE_NB_M-filtered-2025-05-18.csv
Description: an unemployment monthly count by country and age ranges

Columns:
- ‘ref_area.label‘: country indicator
- ‘source.label‘: the source from which the data came from
- ‘indicator.label‘: the indicator which is usually unemployment but by what count
- ‘sex.label‘: sex
- ‘classif1.label‘: age range or other classifiers
- ‘time‘: month and year
- ‘obs_value‘: count value by the count on the indicator
- ‘obs_status.label‘: wether the count is reliable or not (mostly reliable)
- ‘note_classif.label‘: notes on the classifier
- ‘note_indicator.label‘: notes on the indicator
- ‘note_source.label‘: notes on the source

Structure (‘glimpse‘):
Rows: 7,970
Columns: 11
$ ref_area.label <chr> "Australia", "Australia", "Australia", "Australia", "Australia", "Austr...
$ source.label <chr> "LFS - Labour Force Survey", "LFS - Labour Force Survey", "LFS - Labour...
$ indicator.label <chr> "Unemployment by sex and age (thousands)", "Unemployment by sex and age...
$ sex.label <chr> "Total", "Total", "Total", "Total", "Total", "Total", "Total", "Total",...
$ classif1.label <chr> "Age (Youth, adults): 15+", "Age (Youth, adults): 15-64", "Age (Youth, ...
$ time <chr> "2020M12", "2020M12", "2020M12", "2020M12", "2020M12", "2020M12", "2020...
$ obs_value <dbl> 859.814, 843.707, 301.252, 558.562, 859.814, 301.252, 432.529, 109.927,...
$ obs_status.label <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,...
$ note_classif.label <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,...
$ note_indicator.label <chr> "Frequency: Monthly", "Frequency: Monthly", "Frequency: Monthly", "Freq...

```
$ note_source.label    <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,...
```

0.5.2 Source code

```
knitr::opts_chunk$set(
  echo = FALSE,
  warning = FALSE,
  message = FALSE,
  fig.width = 6,
  fig.height = 4,
  out.width = "80%"
)
library(tidyverse)
library(broom)
library(htmltools)
library(readr)
library(dplyr)
library(ggplot2)
library(patchwork)


df <- read_csv("merged_deaths_violence_final.csv")


df_summary <- df %>%
  mutate(year_month = as.Date(paste0(year_month, "-01"))) %>%
  group_by(year_month) %>%
  summarise(
    avg_deaths = mean(monthly_avg_deaths, na.rm = TRUE),
    avg_violence = mean(violence_indicator, na.rm = TRUE)
  ) %>%
  mutate(deaths_per_100k = avg_deaths * 100000)


p1 <- ggplot(df_summary, aes(x = year_month, y = deaths_per_100k, group = 1)) +
  geom_line(color = "firebrick", size = 1.2) +
  geom_point(color = "firebrick", size = 2) +
  labs(title = "Deaths per 100,000 Over Time",
       x = "Month", y = "Deaths per 100K") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))


p2 <- ggplot(df_summary, aes(x = year_month, y = avg_violence, group = 1)) +
  geom_line(color = "steelblue", size = 1.2) +
  geom_point(color = "steelblue", size = 2) +
  labs(title = "Violence Indicator Over Time",
       x = "Month", y = "Violence Indicator") +
  theme_minimal() +
```

```r
  theme(axis.text.x = element_text(angle = 45, hjust = 1))


(p1 + p2) +
  plot_annotation(title = "Comparison Between Deaths and Violence Trends")



library(dplyr)
library(readr)
library(stringr)


merge <- read_csv("merged_deaths_violence_final.csv", show_col_types = FALSE) %>%
  mutate(Entity = str_to_lower(Entity),
         year_month = as.character(year_month))

unemp <- read_csv("UNE_TUNE_SEX_AGE_NB_M-filtered-2025-05-18.csv", show_col_types = FALSE) %>%
  mutate(
    Entity = str_to_lower(`ref_area.label`),
    year_month = str_replace(time, "M", "-")
  )

unemp_summary <- unemp %>%
  group_by(Entity, year_month) %>%
  summarise(unemployment_rate = mean(obs_value, na.rm = TRUE), .groups = "drop")


merged_final <- merge %>%
  left_join(unemp_summary, by = c("Entity", "year_month"))

write_csv(merged_final, "merged_with_unemployment.csv")


library(dplyr)
library(readr)
library(ggplot2)
library(gridExtra)

df <- read_csv("merged_with_unemployment.csv")

df_filtered <- df %>% filter(!is.na(unemployment_rate))


monthly_avg <- df_filtered %>%
  group_by(year_month) %>%
  summarise(
    avg_unemployment = mean(unemployment_rate, na.rm = TRUE),
    avg_violence = mean(violence_indicator, na.rm = TRUE),
    .groups = "drop"
  )

monthly_avg$year_month <- as.Date(paste0(monthly_avg$year_month, "-01"))
```

```r
p1 <- ggplot(monthly_avg, aes(x = year_month, y = avg_unemployment)) +
  geom_line(color = "orange", size = 1.2) +
  geom_point(color = "orange", size = 2) +
  labs(title = "Average Unemployment Rate (with data)",
       x = "Month", y = "Unemployment per 1,000 people") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))


p2 <- ggplot(monthly_avg, aes(x = year_month, y = avg_violence)) +
  geom_line(color = "steelblue", size = 1.2) +
  geom_point(color = "steelblue", size = 2) +
  labs(title = "Average Violence Indicator (with unemployment data)",
       x = "Month", y = "Violence Indicator") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))


grid.arrange(p1, p2, ncol = 2, top = "Trends in Unemployment and Violence (with overlapping data only)")


library(scales)
library(readr)
library(dplyr)
library(ggplot2)
library(lubridate)
library(forcats)

# === Load and prepare data ===
dv <- read_csv("merged_with_unemployment.csv") %>%
  rename(country = Entity) %>%
  mutate(month = as.Date(paste0(year_month, "-01"))) %>%
  filter(Indicator == "Sexual violence or physical assault by IPFM*  (domestic violence): Total number o
  mutate(country = toupper(country))

lockdowns <- read_csv("greece_spain_newzealand_lockdowns.csv") %>%
  mutate(country = toupper(country),
         month = as.Date(paste0(year_month, "-01")))

selected_countries <- c("GREECE", "SPAIN", "NEW ZEALAND")

# Merge & clean
merged <- dv %>%
  filter(country %in% selected_countries) %>%
  left_join(lockdowns, by = c("country", "month")) %>%
  mutate(lockdown_length = replace_na(lockdown_length, 0)) %>%
  filter(format(month, "%Y-%m") != "2020-08")


# Clean and structure data
library(RColorBrewer)
```

```r
# Assuming 'merged' is your combined dataset
plot_df <- merged %>%
  filter(format(month, "%Y-%m") != "2020-08") %>%
  mutate(
    country = factor(country, levels = c("GREECE", "SPAIN", "NEW ZEALAND")),
    month = as.Date(month)
  ) %>%
  group_by(country) %>%
  arrange(month) %>%
  mutate(
    dv_index = violence_indicator / first(violence_indicator) * 100
  ) %>%
  ungroup()

# Define a colorblind-friendly palette
cb_palette <- brewer.pal(n = 3, name = "Set2")

# Create the line plot
ggplot(plot_df, aes(x = month, y = dv_index, color = country)) +
  geom_line(size = 1) +
  geom_point(aes(size = lockdown_length), alpha = 0.8) +
  scale_color_manual(values = cb_palette) +
  scale_size_continuous(range = c(2, 6), name = "Lockdown Days") +
  scale_x_date(date_labels = "%b %Y", breaks = "1 month") +
  scale_y_continuous(labels = label_number(suffix = "%")) +
  labs(
    title = "Monthly Domestic Violence Trends During COVID-19",
    subtitle = "Lines represent DV offenses; point size indicates lockdown duration",
    x = "Month",
    y = "DV Index (First Month = 100)",
    color = "Country"
  ) +
  theme_minimal(base_size = 7) +
  theme(
    # Legend styling (already working)
    legend.position = "top",
    legend.box.margin = margin(t = 10, r = 5, b = 10, l = 0),
    legend.margin = margin(t = 3, b = 3),
    legend.title = element_text(size = 12, face = "bold"),
    legend.text = element_text(size = 8),

    # Axes text (tick labels)
    axis.text.x = element_text(size = 10),
    axis.text.y = element_text(size = 10),

    # Axes titles
    axis.title.x = element_text(size = 13, face = "bold"),
    axis.title.y = element_text(size = 13, face = "bold"),

    # Titles
    plot.title = element_text(size = 16, face = "bold", hjust = 0.5),
    plot.subtitle = element_text(size = 13, hjust = 0.5)
  )
```

```r
cat(readLines('../data/README.md'), sep = '\n')
```