Domestic abuse in Scotland

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Aim

To create data science workflow to study the trend of domestic abuse incidents and crimes in Scotland from 2003 to 2021, as well as the prevalence of domestic abuse across NHS health boards in 2021.

Load packages

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(viridis)
```

```
## Loading required package: viridisLite
```

```
library(patchwork)
library(plotly)
```

```
##
## Attaching package: 'plotly'
##
## The following object is masked from 'package:ggplot2':
##
##     last_plot
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following object is masked from 'package:graphics':
##
##     layout
```

Data acquisition

Domestic abuse data sets contain information on the number of domestic abuse incidents and crimes recorded by Scotland police, and the prevalence (Crude rate per 10,000 population) recorded from 2003 to 2021 across Scotland and NHS Scotland health boards. The data sets were downloaded from the Scottish Government (Scottish Crime Statistics) available on Scottish Public Health Observatory

```
library(here)
```

```
## here() starts at /Users/alifyamukadam/Documents/GitHub/R_Project/R_report
```

```
DA_Scot_data <- read_csv(here("inputs/Domestic-abuse-data_Scotland.csv"))
```

```
## Rows: 19 Columns: 11
```

```
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (6): area_code, area_type, area_name, period, type_definition, indicator
## dbl (5): year, numerator, measure, upper_confidence_interval, lower_confiden...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
DA_Scot_HB_data <- read_csv(here("inputs/Scoland-HB-data.csv"))
```

```
## Rows: 266 Columns: 11
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (6): area_code, area_type, area_name, period, type_definition, indicator
## dbl (5): year, numerator, measure, upper_confidence_interval, lower_confiden...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Prepare the data

```
glimpse(DA_Scot_data) %>%
summary()
```

```
## Rows: 19
## Columns: 11
## $ area_code                <chr> "S00000001", "S00000001", "S00000001", "S000~
## $ area_type                <chr> "Scotland", "Scotland", "Scotland", "Scotlan~
## $ area_name                <chr> "Scotland", "Scotland", "Scotland", "Scotlan~
## $ year                     <dbl> 2003, 2004, 2005, 2006, 2007, 2008, 2009, 20~
## $ period                   <chr> "2003/04 financial year", "2004/05 financial~
## $ type_definition          <chr> "Crude rate per 10,000 population", "Crude r~
## $ indicator                <chr> "Domestic abuse", "Domestic abuse", "Domesti~
## $ numerator                <dbl> 41235, 43633, 45331, 48884, 49949, 53931, 51~
## $ measure                  <dbl> 81.4, 85.8, 88.7, 95.2, 96.6, 103.7, 99.2, 1~
## $ upper_confidence_interval <dbl> 82.1, 86.6, 89.5, 96.1, 97.5, 104.5, 100.1, ~
## $ lower_confidence_interval <dbl> 80.6, 85.0, 87.9, 94.4, 95.8, 102.8, 98.4, 1~
```

```
##   area_code          area_type          area_name             year
##  Length:19          Length:19          Length:19          Min.   :2003
##  Class :character   Class :character   Class :character   1st Qu.:2008
##  Mode  :character   Mode  :character   Mode  :character   Median :2012
##                                                           Mean   :2012
##                                                           3rd Qu.:2016
##                                                           Max.   :2021
##     period          type_definition     indicator          numerator
##  Length:19          Length:19          Length:19          Min.   :41235
##  Class :character   Class :character   Class :character   1st Qu.:50938
##  Mode  :character   Mode  :character   Mode  :character   Median :58439
##                                                           Mean   :55731
##                                                           3rd Qu.:59981
##                                                           Max.   :65251
##     measure      upper_confidence_interval lower_confidence_interval
##  Min.   : 81.4   Min.   : 82.1             Min.   : 80.6
##  1st Qu.: 97.9   1st Qu.: 98.8             1st Qu.: 97.1
##  Median :108.8   Median :109.7             Median :107.9
##  Mean   :105.0   Mean   :105.9             Mean   :104.1
##  3rd Qu.:112.5   3rd Qu.:113.3             3rd Qu.:111.5
##  Max.   :119.4   Max.   :120.3             Max.   :118.5
```

```
glimpse(DA_Scot_HB_data) %>%
  summary()
```

```
## Rows: 266
## Columns: 11
## $ area_code                <chr> "S08000015", "S08000015", "S08000015", "S080~
## $ area_type                <chr> "Health board", "Health board", "Health boar~
## $ area_name                <chr> "NHS Ayrshire & Arran", "NHS Ayrshire & Arra~
## $ year                     <dbl> 2003, 2004, 2005, 2006, 2007, 2008, 2009, 20~
## $ period                   <chr> "2003/04 financial year", "2004/05 financial~
## $ type_definition          <chr> "Crude rate per 10,000 population", "Crude r~
## $ indicator                <chr> "Domestic abuse", "Domestic abuse", "Domesti~
## $ numerator                <dbl> 2589, 3213, 3171, 3679, 3868, 3996, 4251, 44~
## $ measure                  <dbl> 70.4, 87.2, 85.9, 99.6, 104.3, 107.4, 114.1,~
## $ upper_confidence_interval <dbl> 73.2, 90.2, 89.0, 102.9, 107.7, 110.8, 117.6~
## $ lower_confidence_interval <dbl> 67.7, 84.2, 83.0, 96.4, 101.1, 104.1, 110.7,~
```

```
##   area_code          area_type          area_name             year
##  Length:266         Length:266         Length:266         Min.   :2003
##  Class :character   Class :character   Class :character   1st Qu.:2007
##  Mode  :character   Mode  :character   Mode  :character   Median :2012
##                                                           Mean   :2012
##                                                           3rd Qu.:2017
##                                                           Max.   :2021
##     period          type_definition     indicator          numerator
##  Length:266         Length:266         Length:266         Min.   :   21.0
##  Class :character   Class :character   Class :character   1st Qu.:  858.8
##  Mode  :character   Mode  :character   Mode  :character   Median : 3485.0
##                                                           Mean   : 3980.8
##                                                           3rd Qu.: 4982.5
##                                                           Max.   :17412.0
```

```
##     measure       upper_confidence_interval lower_confidence_interval
##  Min.   : 10.10   Min.   : 15.50            Min.   :  6.30
##  1st Qu.: 60.38   1st Qu.: 64.97            1st Qu.: 54.70
##  Median : 91.20   Median : 94.20            Median : 88.20
##  Mean   : 86.82   Mean   : 91.28            Mean   : 82.72
##  3rd Qu.:114.40   3rd Qu.:118.08            3rd Qu.:111.65
##  Max.   :153.40   Max.   :155.70            Max.   :151.10
```

Data cleaning

Select and tidy the data to plot domestic abuse trend in Scotland

```
DA_trend_data <- DA_Scot_data %>%
  select('area_name','year','measure') %>%
  rename('Area'= 'area_name',
         'Year' = 'year',
         'Prevalence' = 'measure'
         )

head(DA_trend_data)
```

```
## # A tibble: 6 x 3
##   Area      Year Prevalence
##   <chr>    <dbl>      <dbl>
## 1 Scotland  2003       81.4
## 2 Scotland  2004       85.8
## 3 Scotland  2005       88.7
## 4 Scotland  2006       95.2
## 5 Scotland  2007       96.6
## 6 Scotland  2008      104.
```

Select and tidy the data to plot domestic abuse across Scotland NHS health boards in 2021

```
DA_2021_HB_data <- DA_Scot_HB_data %>%
  filter(year == "2021") %>%
  select('area_name','measure') %>%
  mutate(area_name = gsub("NHS", "", area_name)) %>%
  rename('NHS_Health_Board' = 'area_name',
         'Prevalence' = 'measure') %>%
  arrange(desc(Prevalence))

head(DA_2021_HB_data)
```

```
## # A tibble: 6 x 2
##   NHS_Health_Board           Prevalence
##   <chr>                           <dbl>
## 1 " Fife"                          144.
## 2 " Forth Valley"                  130.
## 3 " Lanarkshire"                   129.
```

```
## 4 " Greater Glasgow & Clyde"       126.
## 5 " Tayside"                       123.
## 6 " Ayrshire & Arran"              122.
```

```
summary(DA_2021_HB_data)
```

```
##  NHS_Health_Board     Prevalence
##  Length:14          Min.   : 40.40
##  Class :character   1st Qu.: 89.95
##  Mode  :character   Median :116.00
##                     Mean   :103.73
##                     3rd Qu.:124.97
##                     Max.   :143.50
```

Categorisation

```
DA_2021_HB_categorised_data <- DA_2021_HB_data %>%
  mutate(Category = case_when(
    Prevalence <= 89.95 ~ "Low",
    Prevalence > 89.95 & Prevalence <= 124.97 ~ "Medium",
    Prevalence > 124.97 ~ "High"))

head(DA_2021_HB_categorised_data)
```

```
## # A tibble: 6 x 3
##   NHS_Health_Board           Prevalence Category
##   <chr>                           <dbl> <chr>
## 1 " Fife"                          144. High
## 2 " Forth Valley"                  130. High
## 3 " Lanarkshire"                   129. High
## 4 " Greater Glasgow & Clyde"       126. High
## 5 " Tayside"                       123. Medium
## 6 " Ayrshire & Arran"              122. Medium
```

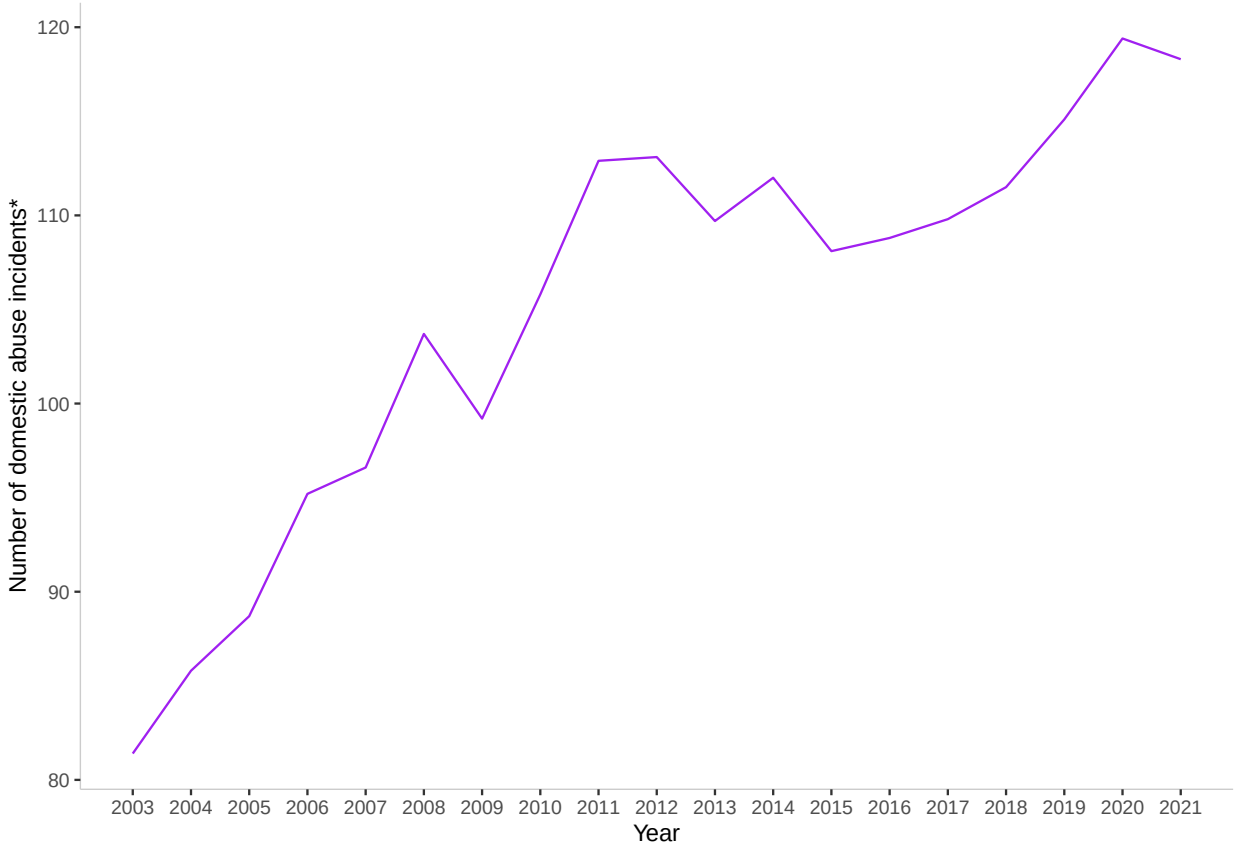
Data visualisation

```
p1 <- DA_trend_data %>%
  ggplot(aes(x = Year,
             y = Prevalence,
             group = 1)) +
  geom_line(colour = "purple") +
  ggtitle("Figure 1: Trend of Domestic abuse in Scotland") +
  xlab("Year")+
  ylab("Number of domestic abuse incidents*") +
  labs(caption = "*indicates crude rate per 10,000 population") +
  scale_x_continuous (breaks = seq(2003, 2021, by=1) ) +
  theme(panel.background = element_rect(fill = NA),
        axis.line = element_line(linewidth = 0.3, colour = "grey80"))
```

```
p2 <- DA_2021_HB_categorised_data %>%
  ggplot(aes(x = reorder(NHS_Health_Board, Prevalence),
             y = Prevalence,
             fill = Category,
             group = 1)) +
  geom_col(alpha = 0.6) +
  coord_flip() +
  ggtitle("Figure 2: Domestic abuse across NHS Scotland Health Boards in 2021") +
  xlab("Health Boards")+
  ylab("Number of domestic abuse incidents*") +
  labs(caption = "*indicates crude rate per 10,000 population") +
  scale_fill_viridis(discrete=TRUE,) +
  theme(panel.background = element_rect(fill = NA),
        axis.line = element_line(linewidth = 0.3, colour = "grey80"),
        legend.position = "bottom")
```

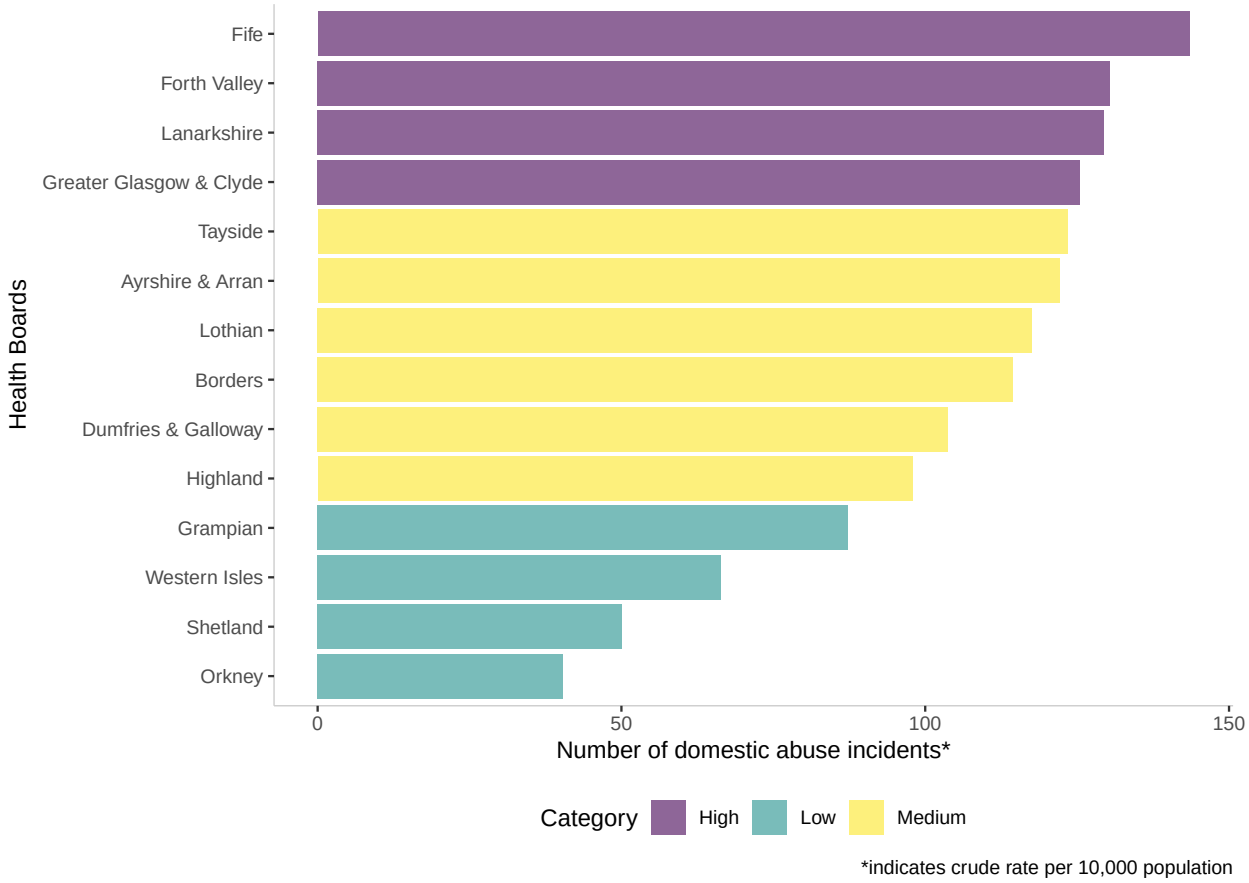
```
p1
```

Figure 1: Trend of Domestic abuse in Scotland




```
p2
```

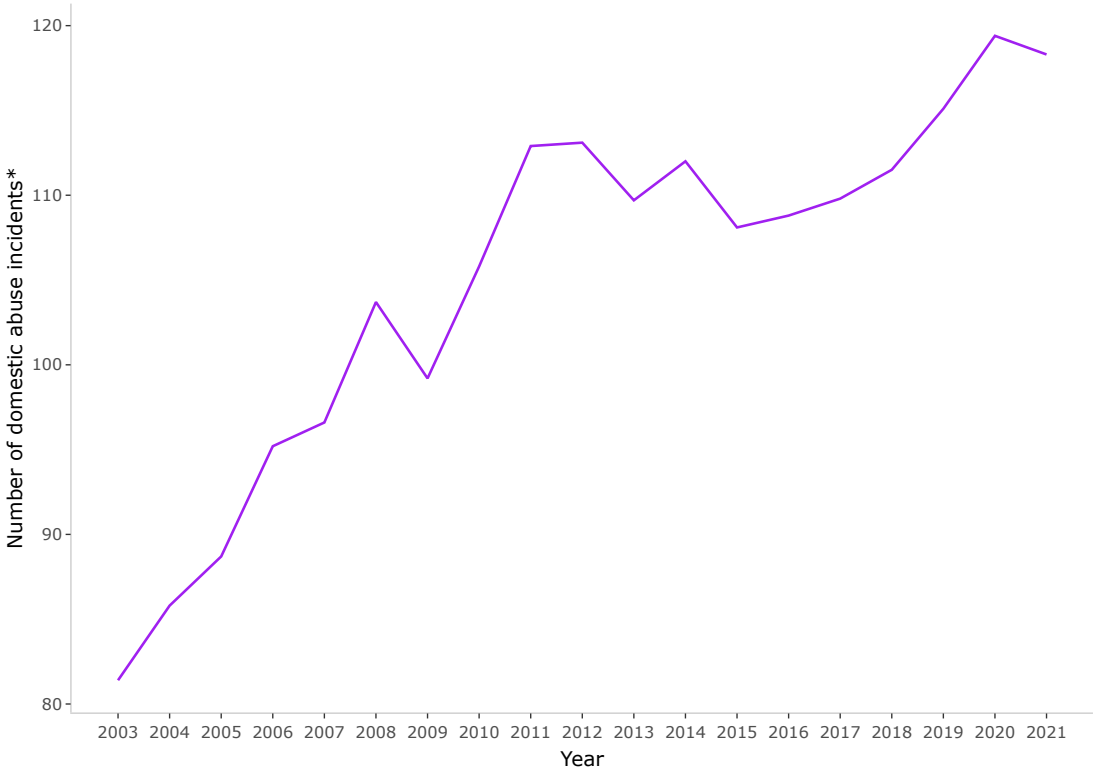
Figure 2: Domestic abuse across NHS Scotland Health Boards in 2021



Interactive plots for .html

```
ggplotly(p1, tooltip = c("x", "y"), width = 800, height = 600)
```

Figure 1: Trend of Domestic abuse in Scotland



Summary

According to UK Office for National Statistics, 26% of women and 15% of men experience some form of domestic abuse between the ages of 16 to 59. (1) Appropriate data visualisations are necessary to create awareness among law enforcement about the increasing trend of domestic abuse over the last 19 years in Scotland. Categorising health boards according to prevalence will enable law enforcement to allocate appropriate resources and develop strategies to address this healthcare issue.

Figure 1 is a line graph that accurately represents the rising trend in Scotland over the last 19 years. Figure 2 is a horizontal bar graph depicting prevalence (crude rate per 10,000 population) across Scotland's NHS health boards in 2021 (most recent data available). The health boards are arranged in descending order of prevalence and categorised into High, Medium, and Low for quick interpretation of the data. The median prevalence in 2021 was *103.73 (143.50,40.40)*. Fife had the highest number of domestic abuse incidents and crime in 2021, while Orkney had the lowest prevalence rate in 2021. Clear and consistent use of a viridis color palette makes the visualizations easy to interpret, and accessible to all, including individuals with color blindness.

However, the data does not highlight variations in age, gender, socioeconomic factors, support services available, and type of abuse. Data is not available after the year 2021. It is also worth noting that this data could be underestimated as data collection relies on people reporting incidents of domestic abuse, which is often under reported. Normalising the health board prevalence data to population size will ensure data is meaningful as regions with larger population will usually have a higher prevalence rate. Data categorisation based on quantiles may not align with clinical or policy-relevant benchmarks. Extensive research is needed to inform new policies in the prevention of domestic violence. (2)

References

1. Elkin, M., 2018. Domestic abuse: Findings from the crime survey for England and Wales: Year ending March 2018. O"ice for National Statistics.

2. Gilchrist, E.L. and Kebbell, M., 2013. Domestic violence: current issues in definitions and interventions with perpetrators in the UK. Forensic Psychology, p.219.