Supplementary Methods

```
weekly_counts <- readRDS("data/weekly_death_counts.rds")
data_by_age <- readRDS("data/weekly_death_counts_by_age.rds")

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 becor
```

```
library(excessmort)
library(MASS)
```

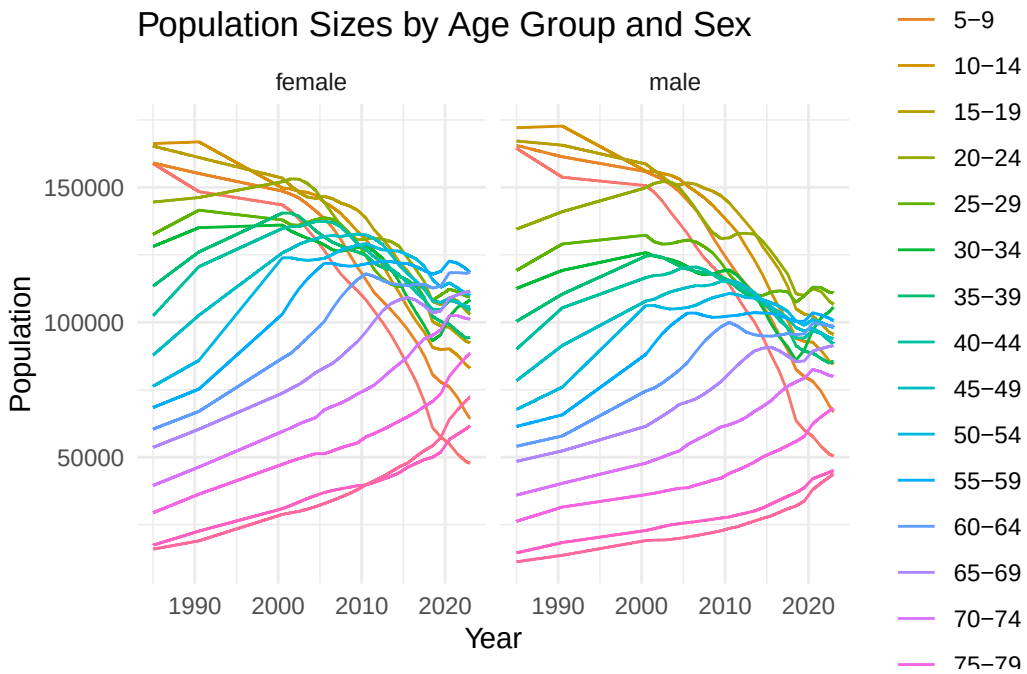
```
Attaching package: 'MASS'

The following object is masked from 'package:dplyr':

    select
```

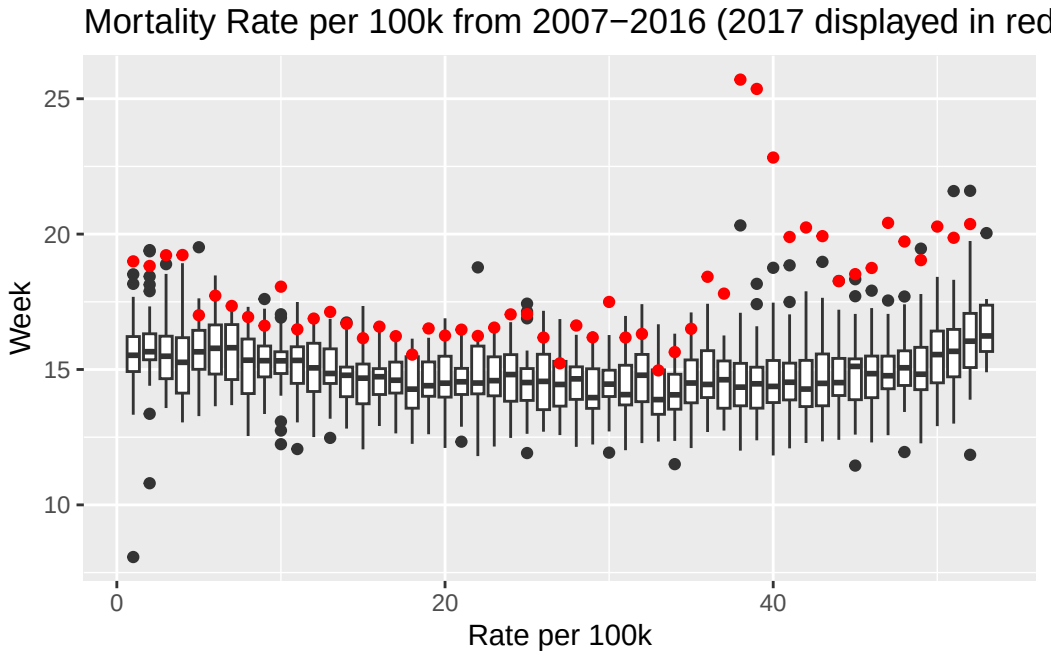
```
library(performance)
```

```
puerto_rico_counts |> ggplot(aes(date, population,
                                 color = agegroup)) +
  geom_line() + facet_wrap(~sex) +
  labs(title = "Population Sizes by Age Group and Sex",
       x = "Year",
       y = "Population") +
  theme_minimal()
```




```
totals <- weekly_counts |>
  group_by(week(date),date) |>
  summarize(rates = sum(outcome)/sum(population) *100000, .groups = "drop")

totals |> filter(year(date) < 2017) |>
  ggplot(aes(week(date), rates, group = week(date))) +
  geom_boxplot() +
  geom_point(data = filter(totals, year(date) == 2017), color = "red") +
  labs(title = "Mortality Rate per 100k from 2007-2016 (2017 displayed in red)",
       x = "Rate per 100k", y = "Week")
```




```
split_by_age <- function(data){
  agegroups <- split(data, data$agegroup)
  df_names <- c()
  for (agegroup in names(agegroups)) {
    df_name <- paste0("lin_reg_data_", agegroup)
    assign(df_name, agegroups[[agegroup]], envir = .GlobalEnv)
    df_names <- c(df_names, df_name)
  }
  print(df_names)
}

split_by_age_robust <- function(data){
  agegroups <- split(data, data$agegroup)
  df_names <- c()
  for (agegroup in names(agegroups)) {
    df_name <- paste0("robust_reg_data_", agegroup)
    assign(df_name, agegroups[[agegroup]], envir = .GlobalEnv)
    df_names <- c(df_names, df_name)
  }
  print(df_names)
}
```

```
age_df <- split_by_age(data_by_age)
```

```
[1] "lin_reg_data_0-4"   "lin_reg_data_5-14"  "lin_reg_data_15-29"
[4] "lin_reg_data_30-54" "lin_reg_data_45-54" "lin_reg_data_55-59"
[7] "lin_reg_data_60-64" "lin_reg_data_65+"
```

```
age_df_robust <- split_by_age_robust(data_by_age)
```

```
[1] "robust_reg_data_0-4"   "robust_reg_data_5-14"  "robust_reg_data_15-29"
[4] "robust_reg_data_30-54" "robust_reg_data_45-54" "robust_reg_data_55-59"
[7] "robust_reg_data_60-64" "robust_reg_data_65+"
```

```
lm_model_fits <- function(agegroups){
  lm_fits <- list()
  for (agegroup in agegroups) {
    dataset <- get(agegroup, envir = .GlobalEnv)
    dataset <- filter(dataset, year(date) < 2017)
    fit <- lm(rate ~ as.factor(week) + sex + diftime + population,
              data = dataset)
    lm_fits[[paste0("fit_", agegroup)]] <- fit
  }
  return(lm_fits)
}

rlm_model_fits <- function(agegroups){
  rlm_fits <- list()
  for (agegroup in agegroups) {
    dataset <- get(agegroup, envir = .GlobalEnv)
    dataset <- filter(dataset, year(date) < 2017)
    fit <- rlm(rate ~ as.factor(week) + sex + diftime + population,
              data = dataset)
    rlm_fits[[paste0("fit_", agegroup)]] <- fit
  }
  return(rlm_fits)
}
```

```
fitted_lm_models <- lm_model_fits(age_df)
fitted_rlm_models <- rlm_model_fits(age_df_robust)
```

```r
compare_performance(fitted_lm_models$`fit_lin_reg_data_0-4`,
                    fitted_rlm_models$`fit_robust_reg_data_0-4`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -19803.5 (0.975) | -19796.7 (0.975) | -19521.3 (0.975)
..2  |   rlm | -19796.1 (0.025) | -19789.4 (0.025) | -19513.9 (0.025)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 1.742e-05 | 1.791e-05 | 0.118 |     0.068
..2  | 1.748e-05 | 1.797e-05 |       |
```

```r
compare_performance(fitted_lm_models$`fit_lin_reg_data_5-14`,
                    fitted_rlm_models$`fit_robust_reg_data_5-14`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -23410.9 (>.999) | -23404.2 (>.999) | -23128.7 (>.999)
..2  |   rlm | -23390.5 (<.001) | -23383.8 (<.001) | -23108.3 (<.001)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 3.095e-06 | 3.182e-06 | 0.074 |     0.022
..2  | 3.126e-06 | 3.213e-06 |       |
```

```r
compare_performance(fitted_lm_models$`fit_lin_reg_data_15-29`,
                    fitted_rlm_models$`fit_robust_reg_data_15-29`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -21392.2 (0.995) | -21385.5 (0.995) | -21110.0 (0.995)
..2  |   rlm | -21381.6 (0.005) | -21374.8 (0.005) | -21099.4 (0.005)
```

```
Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 8.139e-06 | 8.366e-06 | 0.786 |     0.774
..2  | 8.181e-06 | 8.409e-06 |       |
```

```
compare_performance(fitted_lm_models$`fit_lin_reg_data_30-54`,
                    fitted_rlm_models$`fit_robust_reg_data_30-54`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -20863.8 (0.972) | -20857.1 (0.972) | -20581.7 (0.972)
..2  |   rlm | -20856.8 (0.028) | -20850.1 (0.028) | -20574.6 (0.028)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 1.048e-05 | 1.078e-05 | 0.733 |     0.719
..2  | 1.052e-05 | 1.081e-05 |       |
```

```
compare_performance(fitted_lm_models$`fit_lin_reg_data_45-54`,
                    fitted_rlm_models$`fit_robust_reg_data_45-54`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -19546.5 (0.937) | -19539.8 (0.937) | -19264.3 (0.937)
..2  |   rlm | -19541.1 (0.063) | -19534.4 (0.063) | -19258.9 (0.063)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 1.970e-05 | 2.025e-05 | 0.707 |     0.691
..2  | 1.975e-05 | 2.030e-05 |       |
```

```
compare_performance(fitted_lm_models$`fit_lin_reg_data_55-59`,
                    fitted_rlm_models$`fit_robust_reg_data_55-59`)
```

```
# Comparison of Model Performance Indices
```

```
Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -18444.0 (0.960) | -18437.3 (0.960) | -18161.9 (0.960)
..2  |   rlm | -18437.7 (0.040) | -18431.0 (0.040) | -18155.5 (0.040)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 3.340e-05 | 3.434e-05 | 0.699 |     0.682
..2  | 3.350e-05 | 3.444e-05 |       |
```

```
compare_performance(fitted_lm_models$`fit_lin_reg_data_60-64`,
                    fitted_rlm_models$`fit_robust_reg_data_60-64`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -17954.3 (0.974) | -17947.6 (0.974) | -17672.1 (0.974)
..2  |   rlm | -17947.0 (0.026) | -17940.3 (0.026) | -17664.8 (0.026)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 4.223e-05 | 4.341e-05 | 0.711 |     0.695
..2  | 4.238e-05 | 4.356e-05 |       |
```

```
compare_performance(fitted_lm_models$`fit_lin_reg_data_65+`,
                    fitted_rlm_models$`fit_robust_reg_data_65+`)
```

```
# Comparison of Model Performance Indices

Name | Model |    AIC (weights) |   AICc (weights) |    BIC (weights)
-------------------------------------------------------------------
..1  |    lm | -17198.6 (0.968) | -17191.8 (0.968) | -16916.4 (0.968)
..2  |   rlm | -17191.7 (0.032) | -17185.0 (0.032) | -16909.5 (0.032)

Name |      RMSE |     Sigma |    R2 | R2 (adj.)
-----------------------------------------------
..1  | 6.065e-05 | 6.235e-05 | 0.733 |     0.718
..2  | 6.085e-05 | 6.255e-05 |       |
```