CHL8010: Statistical Programming and Computation in Health Data

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Exploratory data analysis

Analysis of final data

```
glimpse(final_data)
```

```
Rows: 3,720
Columns: 21
$ country_name   <chr> "Afghanistan", "Afghanistan", "Afghanistan", "Afghanist~
$ ISO            <chr> "AFG", "AFG", "AFG", "AFG", "AFG", "AFG", "AFG", "AFG",~
$ region         <chr> "Southern Asia", "Southern Asia", "Southern Asia", "Sou~
$ Year           <int> 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2~
$ gdp1000        <dbl> NA, NA, 0.1835328, 0.2004626, 0.2216576, 0.2550551, 0.2~
$ OECD           <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
$ OECD2023       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0~
$ popdens        <dbl> 14.13654, 14.23156, 14.32270, 14.40691, 15.21947, 15.33~
$ urban          <dbl> 16.25324, 16.25661, 16.42654, 16.60701, 16.71367, 16.85~
$ agedep         <dbl> 108.34663, 108.98989, 109.34716, 109.44753, 109.28682, ~
$ male_edu       <dbl> 2.762086, 2.856936, 2.954241, 3.054121, 3.156706, 3.262~
$ temp           <dbl> 12.69959, 12.85570, 12.71081, 12.16592, 13.04643, 12.23~
$ rainfall1000   <dbl> 0.2763704, 0.2793079, 0.3805710, 0.4288939, 0.3754336, ~
$ totaldeath     <int> 5065, 5394, 5553, 1157, 944, 817, 1711, 4982, 7020, 566~
$ armed_conflict <int> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1~
$ Earthquake     <int> 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0~
$ Drought        <int> 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1~
$ matMor         <int> 1450, 1390, 1300, 1240, 1180, 1140, 1120, 1090, 1030, 9~
```

```
$ infMor         <dbl> 90.5, 87.9, 85.3, 82.7, 80.0, 77.3, 74.6, 71.9, 69.2, 6~
$ neoMor         <dbl> 60.9, 59.7, 58.5, 57.2, 55.9, 54.6, 53.2, 51.7, 50.3, 4~
$ under5Mor      <dbl> 129.2, 125.2, 121.1, 116.9, 112.6, 108.4, 104.1, 99.9, ~
```

```
summary(final_data)
```

```
 country_name           ISO                region              Year
 Length:3720        Length:3720        Length:3720        Min.   :2000
 Class :character   Class :character   Class :character   1st Qu.:2005
 Mode  :character   Mode  :character   Mode  :character   Median :2010
                                                          Mean   :2010
                                                          3rd Qu.:2014
                                                          Max.   :2019

    gdp1000              OECD          OECD2023         popdens
 Min.   :  0.1105   Min.   :0.000   Min.   :0.0000   Min.   : 0.00
 1st Qu.:  1.2383   1st Qu.:0.000   1st Qu.:0.0000   1st Qu.:14.79
 Median :  4.0719   Median :0.000   Median :0.0000   Median :27.52
 Mean   : 11.4917   Mean   :0.171   Mean   :0.1882   Mean   :30.57
 3rd Qu.: 13.1531   3rd Qu.:0.000   3rd Qu.:0.0000   3rd Qu.:40.72
 Max.   :123.6787   Max.   :1.000   Max.   :1.0000   Max.   :99.86
 NA's   :62                                          NA's   :20
     urban             agedep          male_edu          temp
 Min.   : 0.1025   Min.   : 16.17   Min.   : 1.067   Min.   :-2.405
 1st Qu.:17.2872   1st Qu.: 47.94   1st Qu.: 5.904   1st Qu.:12.928
 Median :30.2535   Median : 55.51   Median : 8.368   Median :21.958
 Mean   :30.6948   Mean   : 61.94   Mean   : 8.258   Mean   :19.625
 3rd Qu.:41.6558   3rd Qu.: 77.11   3rd Qu.:10.849   3rd Qu.:25.869
 Max.   :93.4135   Max.   :111.48   Max.   :14.441   Max.   :29.676
 NA's   :20                         NA's   :20       NA's   :20
  rainfall1000       totaldeath      armed_conflict     Earthquake
 Min.   :0.01993   Min.   :    0.0   Min.   :0.0000   Min.   :0.00000
 1st Qu.:0.59146   1st Qu.:    0.0   1st Qu.:0.0000   1st Qu.:0.00000
 Median :1.01288   Median :    0.0   Median :0.0000   Median :0.00000
 Mean   :1.20216   Mean   :  361.1   Mean   :0.1892   Mean   :0.08333
 3rd Qu.:1.68706   3rd Qu.:    2.0   3rd Qu.:0.0000   3rd Qu.:0.00000
 Max.   :4.71081   Max.   :78644.0   Max.   :1.0000   Max.   :1.00000
 NA's   :20
    Drought             matMor           infMor           neoMor
 Min.   :0.00000   Min.   :   2.0   Min.   :  1.60   Min.   : 0.80
 1st Qu.:0.00000   1st Qu.:  17.0   1st Qu.:  7.60   1st Qu.: 4.90
 Median :0.00000   Median :  66.0   Median : 18.90   Median :12.10
```

```
 Mean   :0.08737   Mean   : 210.6   Mean   : 28.90   Mean   :16.18
 3rd Qu.:0.00000   3rd Qu.: 299.8   3rd Qu.: 44.52   3rd Qu.:25.32
 Max.   :1.00000   Max.   :2480.0   Max.   :138.10   Max.   :60.90
                   NA's   :426      NA's   :20       NA's   :20
   under5Mor
 Min.   :  2.00
 1st Qu.:  9.00
 Median : 22.20
 Mean   : 40.50
 3rd Qu.: 61.33
 Max.   :224.90
 NA's   :20
```

```
Mor_names <- c("matMor","infMor","neoMor","under5Mor")

for (i in seq_along(Mor_names)){
  Mor <- Mor_names[i]
  plot <- final_data %>% ggplot(aes(Year,.data[[Mor]],
                                    color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
      title = paste("Table",i,"Trends in Mortality Rates by Year"),
      x = "Year",
      y = Mor_names,
      color = "Armed Conflict"
    ) +
    theme_minimal() +
  theme(
    text = element_text(size=8)
  )
  print(plot)
}
```

Table 1 Trends in Mortality Rates by Year

Table 2 Trends in Mortality Rates by Year

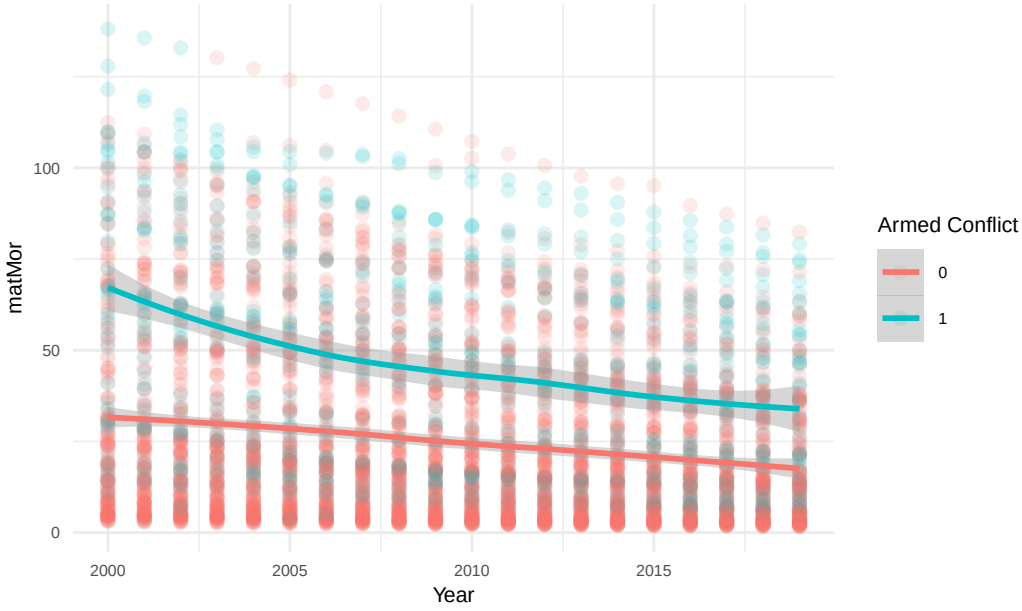


Table 3 Trends in Mortality Rates by Year

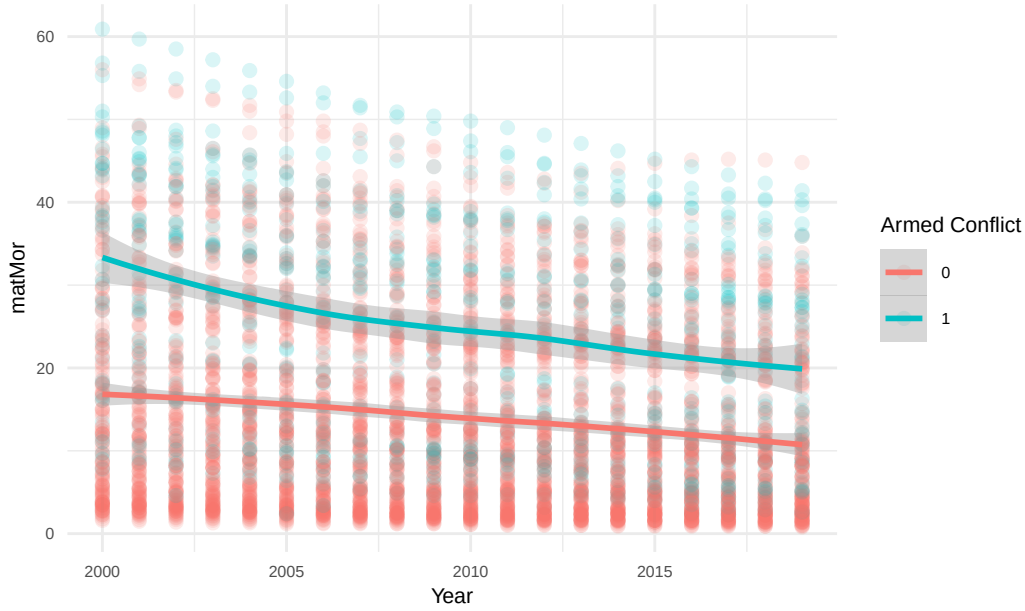
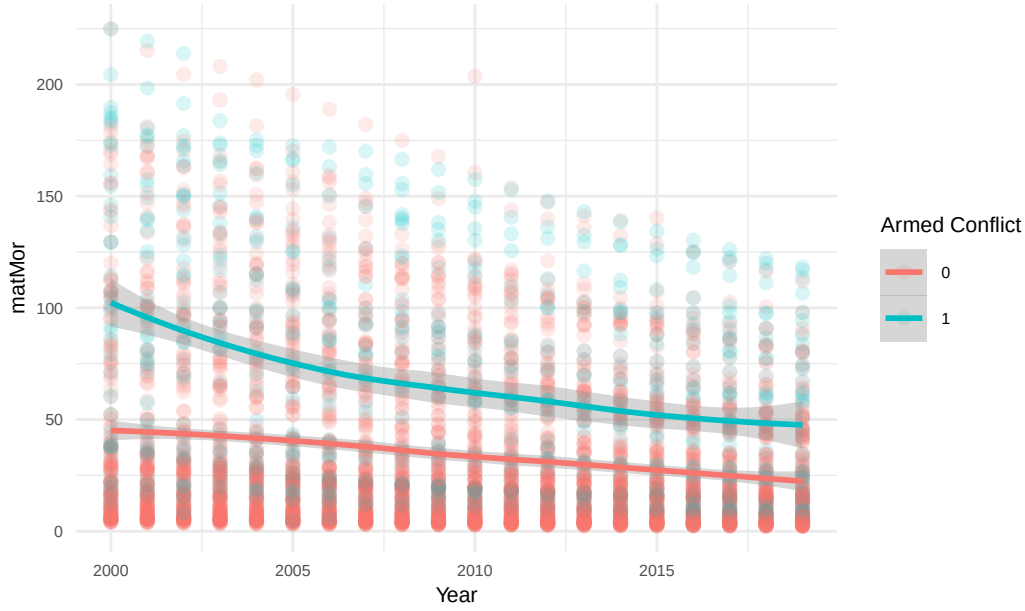
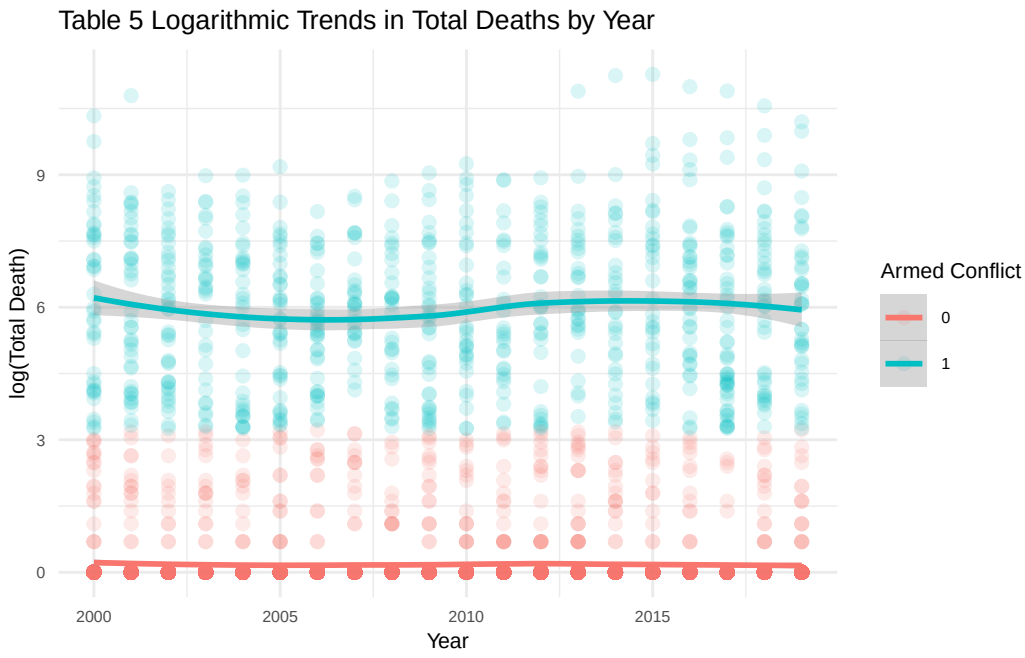


Table 4 Trends in Mortality Rates by Year




```
final_data %>% ggplot(aes(Year,log(totaldeath+1), color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
```

```
      title = "Table 5 Logarithmic Trends in Total Deaths by Year",
      x = "Year",
      y = "log(Total Death)",
      color = "Armed Conflict"
    ) + theme_minimal() +
  theme(
    text = element_text(size=8)
  )
```



Investigate Final Data without countries with 3 highest total death counts for each year.

```
highest_totaldeath <- final_data %>%
  group_by(Year) %>%
  slice_max(totaldeath, n = 3)

highest_totaldeath %>% select(country_name,Year, totaldeath)
```

```
# A tibble: 60 x 3
# Groups:   Year [20]
```

```
   country_name                    Year totaldeath
   <chr>                          <int>      <int>
 1 Ethiopia                        2000      30786
 2 Eritrea                         2000      17203
 3 Democratic Republic of the Congo 2000       7541
 4 Ethiopia                        2001      48666
 5 Afghanistan                     2001       5394
 6 Russian Federation              2001       4333
 7 Afghanistan                     2002       5553
 8 Colombia                        2002       4592
 9 Sudan                           2002       3719
10 Democratic Republic of the Congo 2003       7931
# i 50 more rows
```

```r
finaldata_without3highest <- anti_join(final_data,highest_totaldeath,
                                       by=c("country_name","Year"))

head(finaldata_without3highest)
```

```
  country_name ISO          region Year   gdp1000 OECD OECD2023  popdens
1  Afghanistan AFG   Southern Asia 2000        NA    0        0 14.13654
2  Afghanistan AFG   Southern Asia 2003 0.2004626    0        0 14.40691
3  Afghanistan AFG   Southern Asia 2004 0.2216576    0        0 15.21947
4  Afghanistan AFG   Southern Asia 2005 0.2550551    0        0 15.33619
5  Afghanistan AFG   Southern Asia 2006 0.2740005    0        0 15.43982
6      Albania ALB Southern Europe 2000 1.1266833    0        0 33.08368
     urban   agedep male_edu     temp rainfall1000 totaldeath armed_conflict
1 16.25324 108.3466 2.762086 12.69959    0.2763704       5065              1
2 16.60701 109.4475 3.054121 12.16592    0.4288939       1157              1
3 16.71367 109.2868 3.156706 13.04643    0.3754336        944              1
4 16.85096 107.9646 3.262133 12.23141    0.4415680        817              1
5 16.98105 106.3262 3.370551 12.96153    0.4437097       1711              1
6 27.38836  59.6573 8.961755 13.73920    0.7971749          6              0
  Earthquake Drought matMor infMor neoMor under5Mor
1          0       1   1450   90.5   60.9     129.2
2          1       0   1240   82.7   57.2     116.9
3          1       0   1180   80.0   55.9     112.6
4          1       0   1140   77.3   54.6     108.4
5          1       1   1120   74.6   53.2     104.1
6          0       0     23   24.1   12.1      27.2
```

```r
Mor_names <- c("matMor","infMor","neoMor","under5Mor")

for (i in seq_along(Mor_names)){
  Mor <- Mor_names[i]
  plot <- finaldata_without3highest %>% ggplot(aes(Year,.data[[Mor]],
                                                   color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
      title = paste("Table", i+5, "Trends in Mortality Rates Excluding Countries with the Th
      x = "Year",
      y = Mor_names,
      color = "Armed Conflict"
    ) +
    theme_minimal() +
  theme(
    text = element_text(size=8)
  )
  print(plot)
}
```

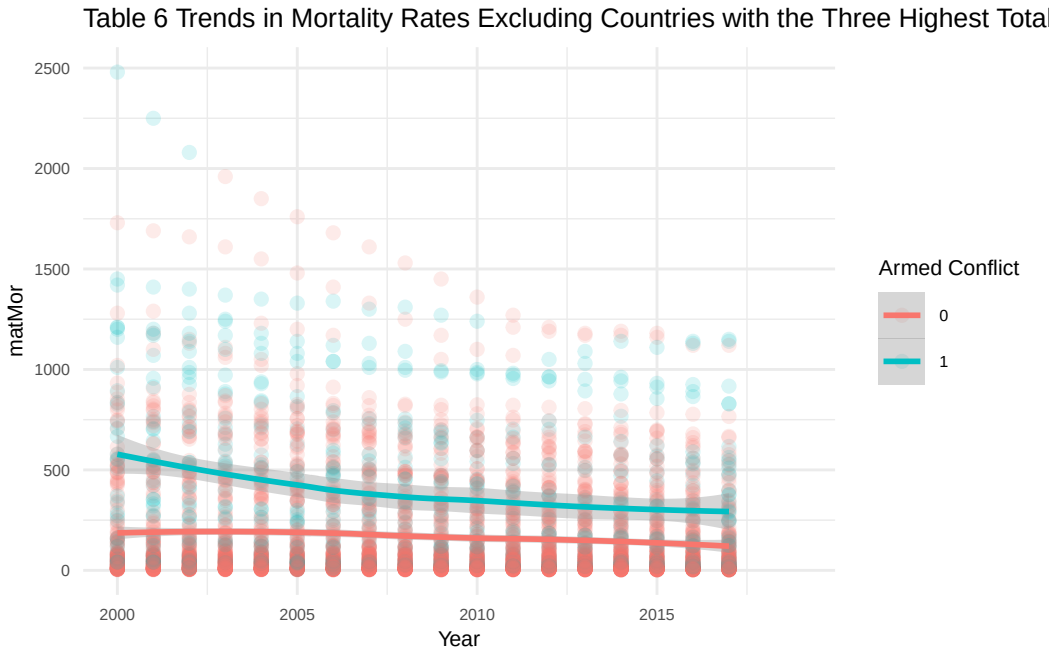


Table 7 Trends in Mortality Rates Excluding Countries with the Three Highest Total

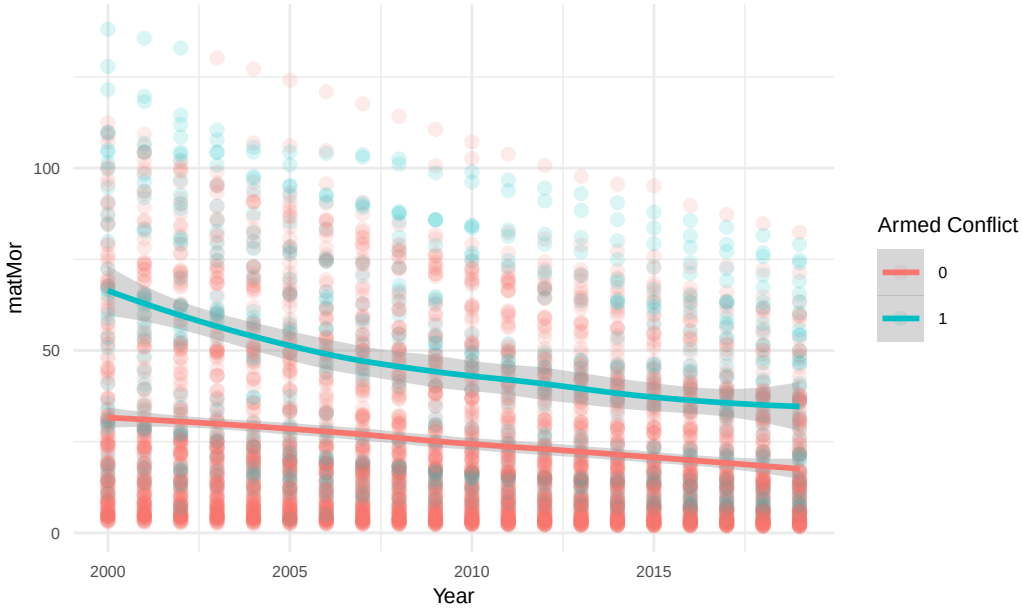


Table 8 Trends in Mortality Rates Excluding Countries with the Three Highest Total I

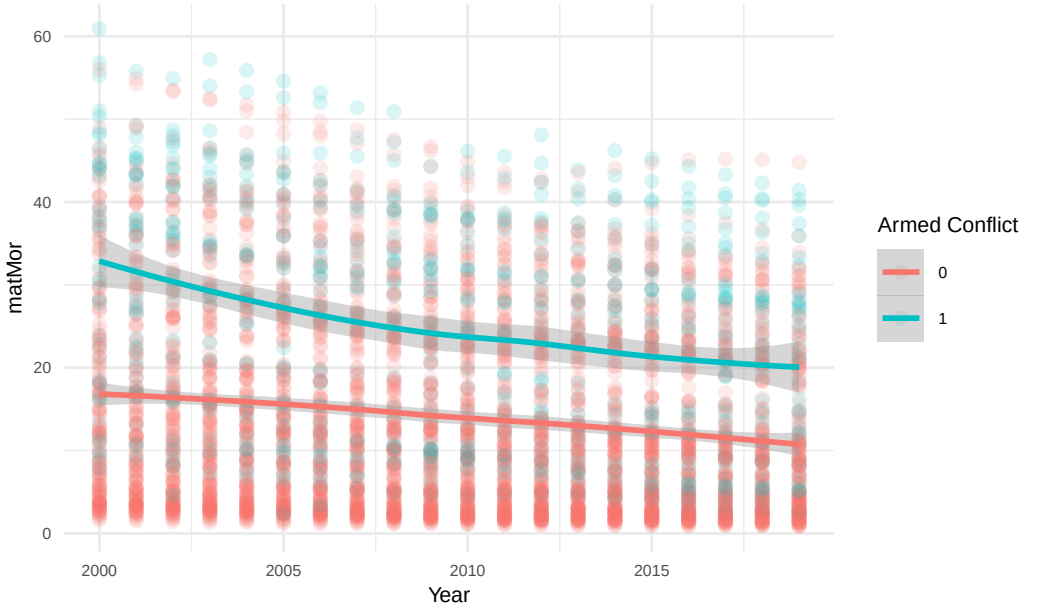
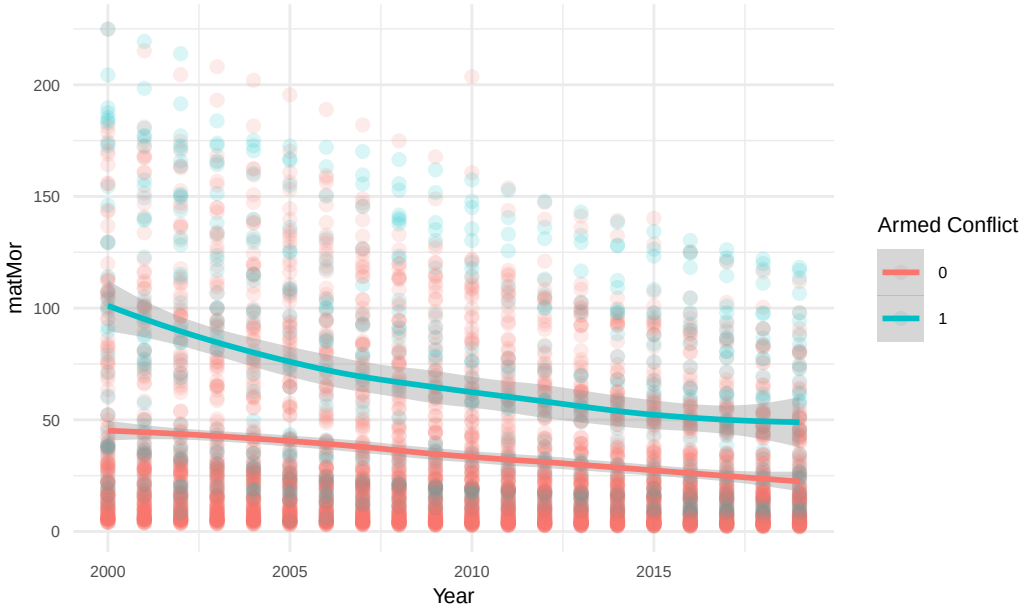
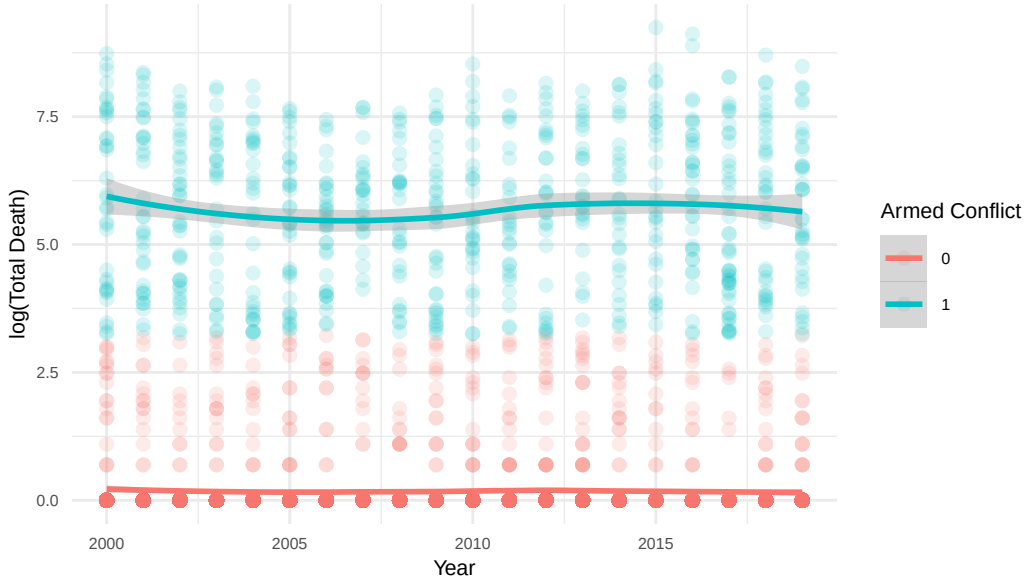


Table 9 Trends in Mortality Rates Excluding Countries with the Three Highest Total




```
finaldata_without3highest %>% ggplot(aes(Year,log(totaldeath+1),
                                         color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
      title = str_wrap("Table 10 Logarithmic Trends in Total Deaths Excluding Countries with
      x = "Year",
      y = "log(Total Death)",
      color = "Armed Conflict"
    ) + theme_minimal() +
  theme(
    text = element_text(size=8)
  )
```

Table 10 Logarithmic Trends in Total Deaths Excluding Countries with the Three Highest Death Counts by Year



Investigate OCED countries only

```
oecd_countries <- final_data %>%
  filter(OECD==1)

Mor_names <- c("matMor","infMor","neoMor","under5Mor")

for (i in seq_along(Mor_names)){
  Mor <- Mor_names[i]
  plot <- oecd_countries %>% ggplot(aes(Year,.data[[Mor]],
                                        color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
      title = paste("Table",i+10, "Trends in Mortality Rates in OECD Countries by Year"),
      x = "Year",
      y = Mor_names,
      color = "Armed Conflict"
    ) +
    theme_minimal() +
  theme(
```

```
    text = element_text(size=8)
  )
  print(plot)
}
```

Table 11 Trends in Mortality Rates in OECD Countries by Year

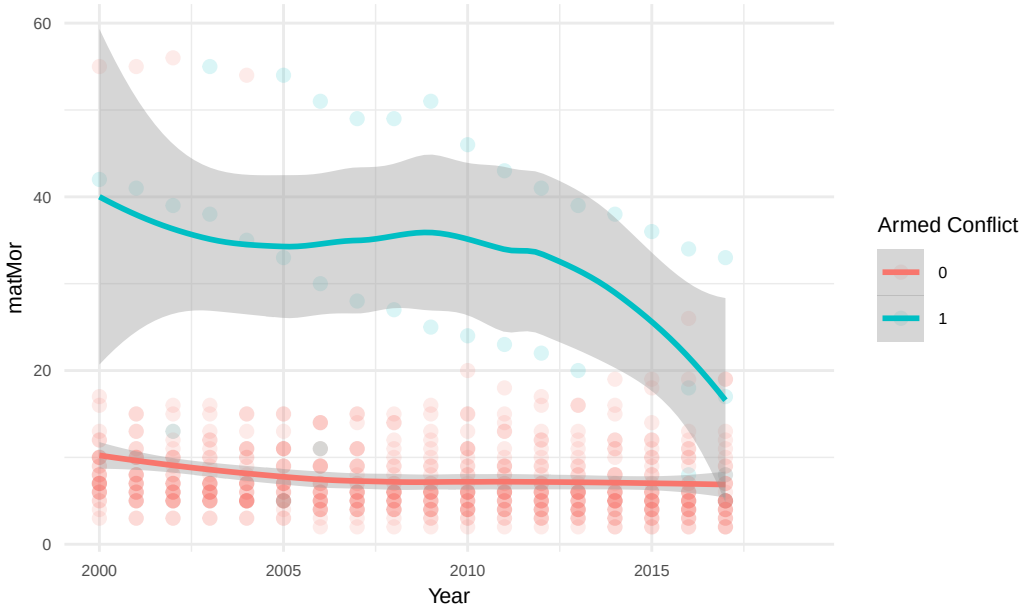


Table 12 Trends in Mortality Rates in OECD Countries by Year

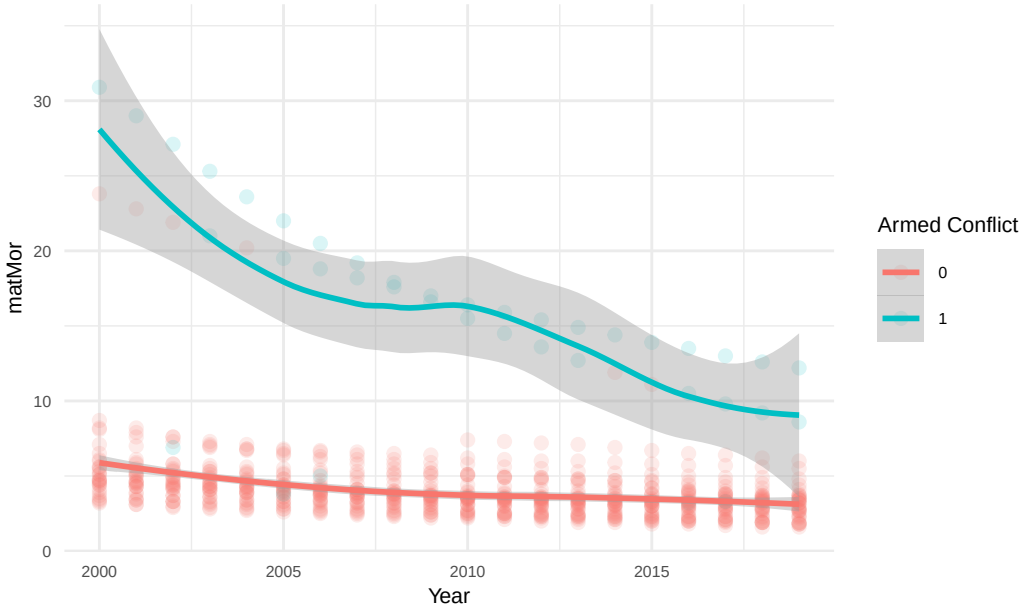


Table 13 Trends in Mortality Rates in OECD Countries by Year

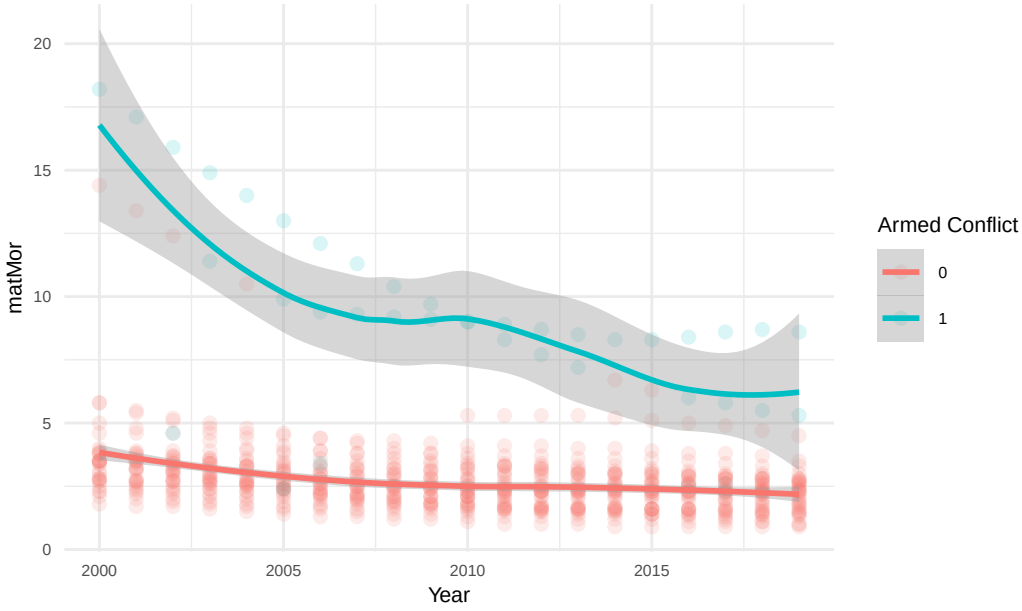
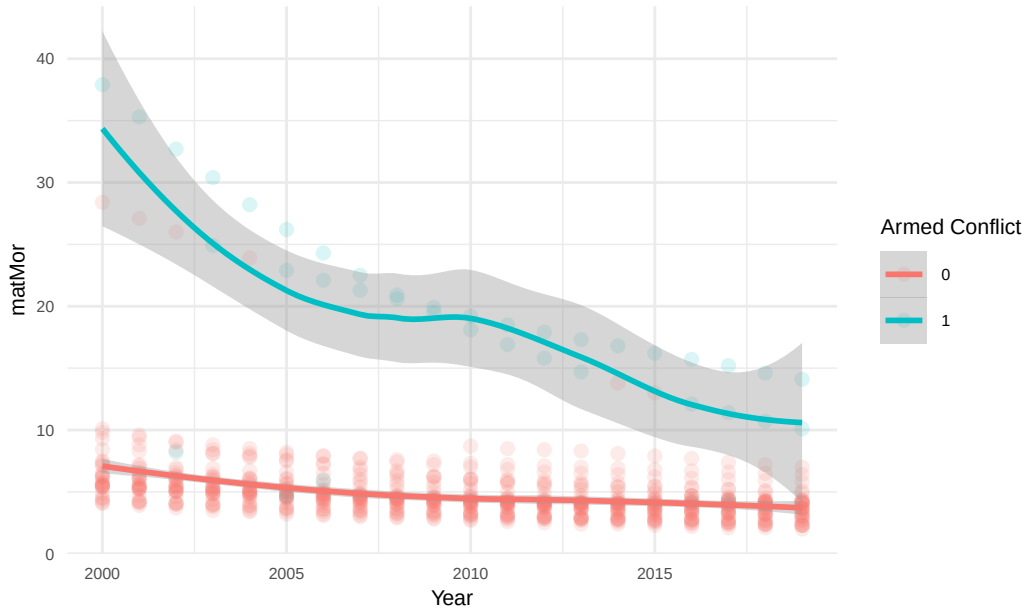
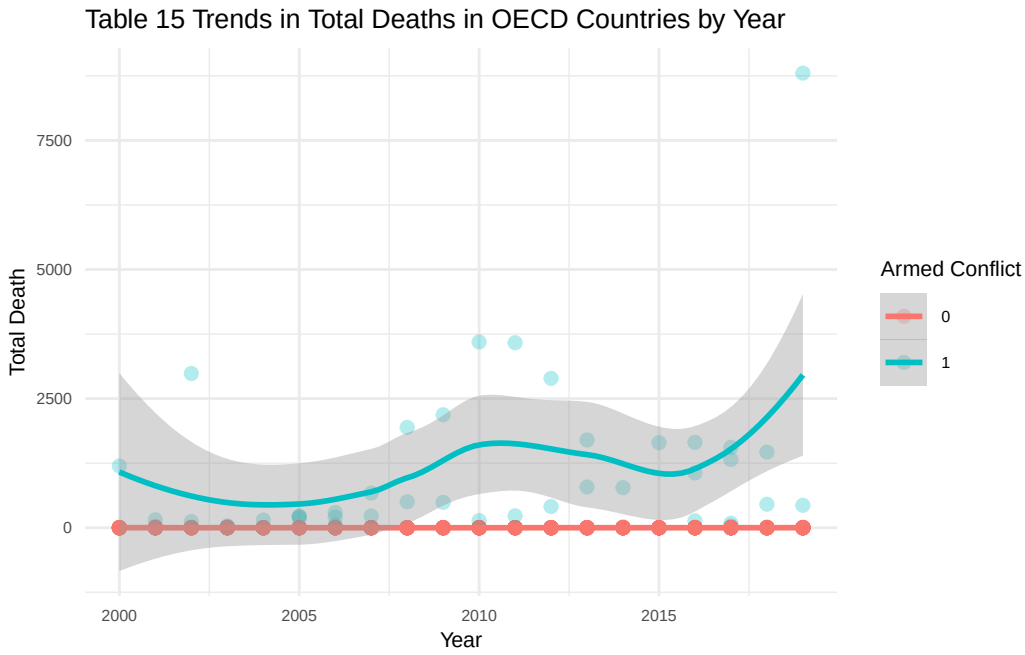


Table 14 Trends in Mortality Rates in OECD Countries by Year




```
oecd_countries %>% ggplot(aes(Year,totaldeath, color=factor(armed_conflict))) +
    geom_point(alpha=0.3, size=2) + geom_smooth(aes(group = armed_conflict),
                                                method = "loess") +
    labs(
      title = "Table 15 Trends in Total Deaths in OECD Countries by Year",
      x = "Year",
      y = "Total Death",
      color = "Armed Conflict"
    ) + theme_minimal() +
  theme(
    text = element_text(size=8)
  )
```



Investigate non OCED countries only

```
non_oecd_countries <- final_data %>%
  filter(OECD==0)

Mor_names <- c("matMor","infMor","neoMor","under5Mor")

for (i in seq_along(Mor_names)){
  Mor <- Mor_names[i]
  plot <- non_oecd_countries %>% ggplot(aes(Year,.data[[Mor]],
                                            color=factor(armed_conflict))) +
    geom_point(alpha=0.15, size=2) + geom_smooth(aes(group = armed_conflict),
                                                 method = "loess") +
    labs(
      title = paste("Table", i+15, "Trends in Mortality Rates in non OECD Countries by Year")
      x = "Year",
      y = Mor_names,
      color = "Armed Conflict"
    ) +
    theme_minimal() +
  theme(
```

```
    text = element_text(size=8)
  )
  print(plot)
}
```

Table 16 Trends in Mortality Rates in non OECD Countries by Year

Table 17 Trends in Mortality Rates in non OECD Countries by Year

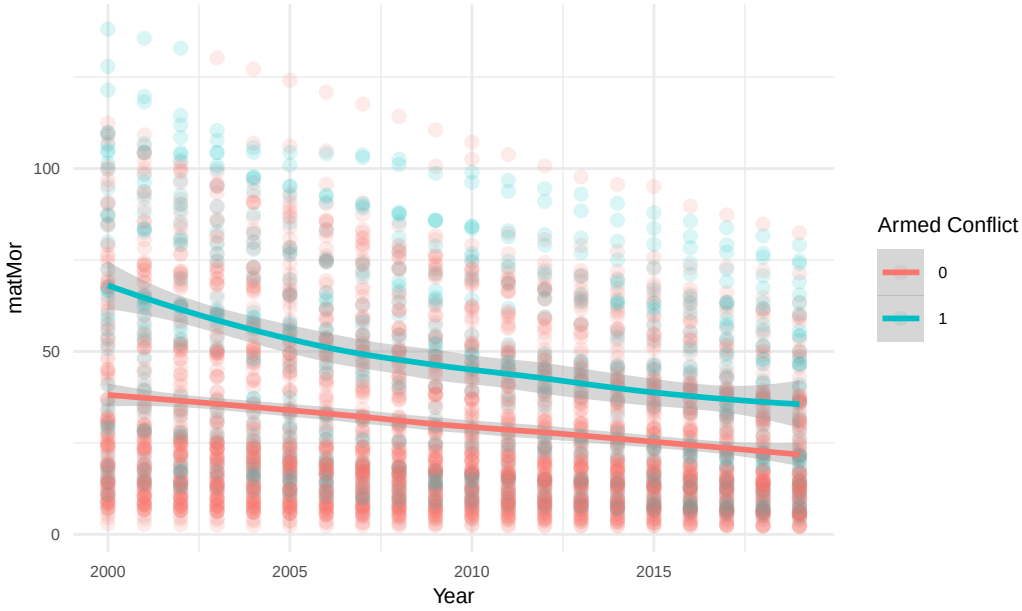


Table 18 Trends in Mortality Rates in non OECD Countries by Year

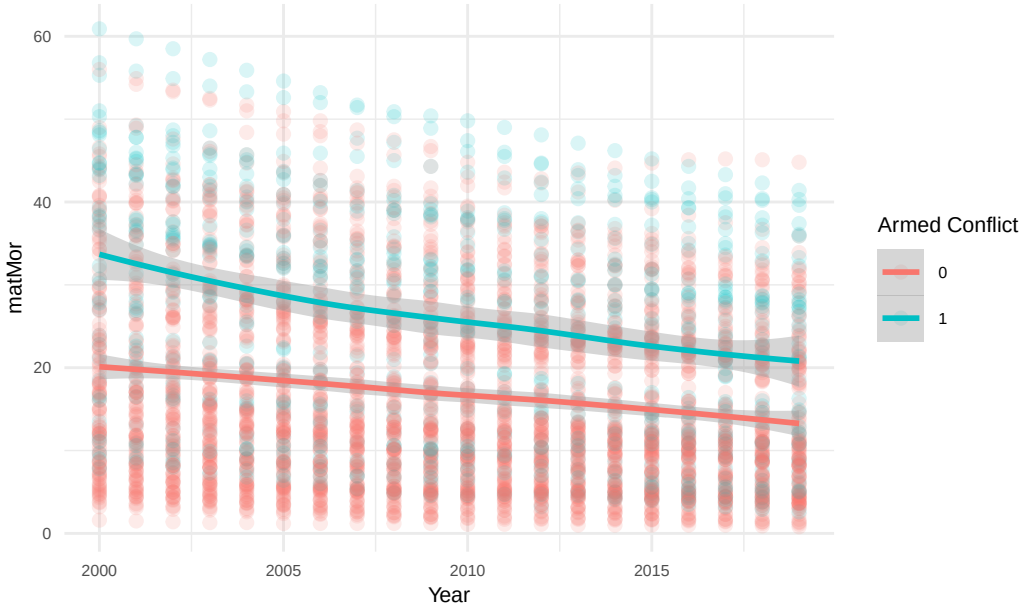
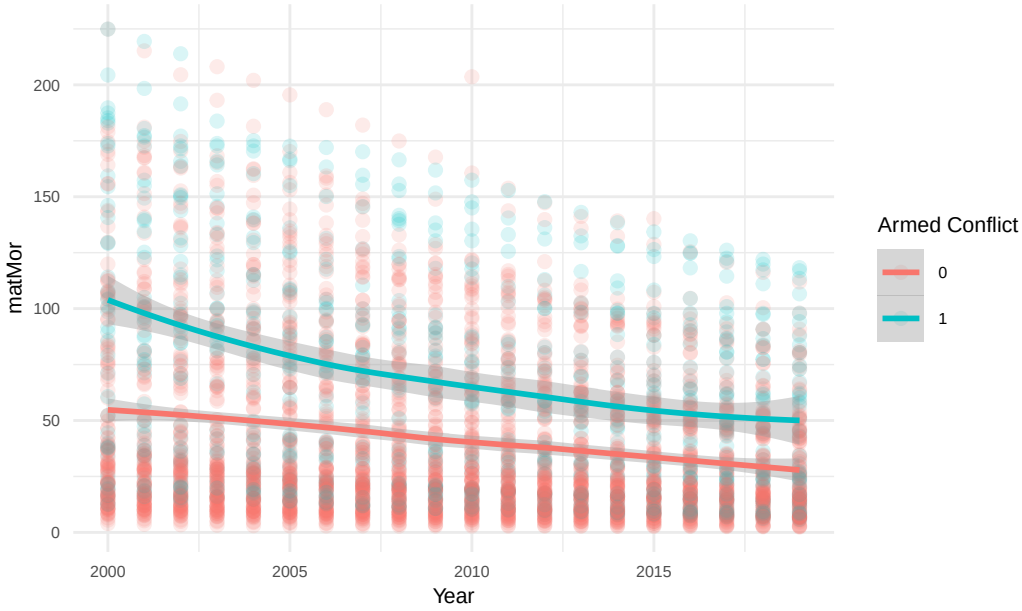
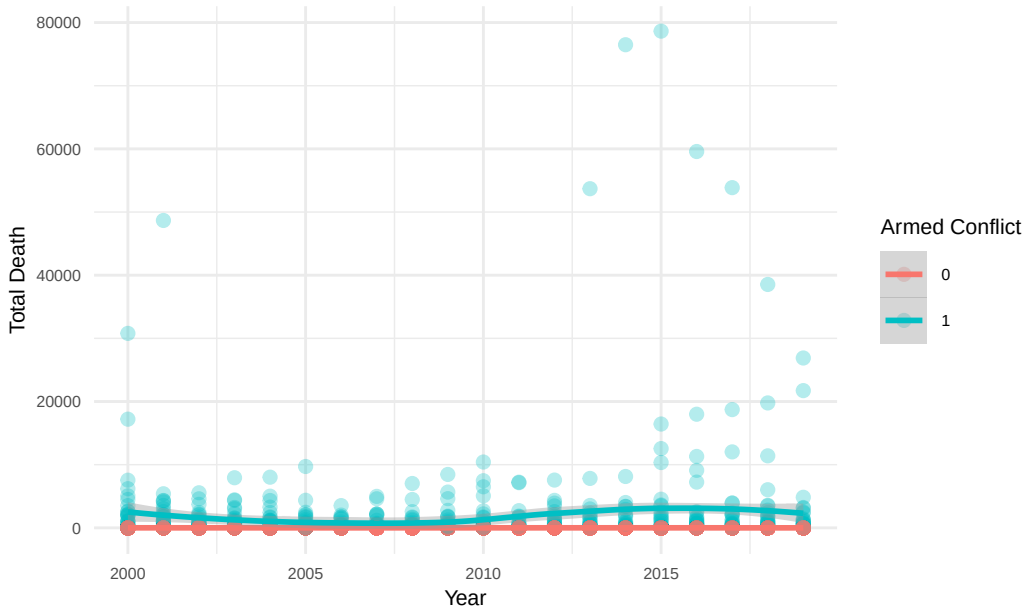


Table 19 Trends in Mortality Rates in non OECD Countries by Year




```
non_oecd_countries %>% ggplot(aes(Year,totaldeath, color=factor(armed_conflict))) +
    geom_point(alpha=0.3, size=2) + geom_smooth(aes(group = armed_conflict),
                                                method = "loess") +
    labs(
      title = "Table 20 Trends in Total Deaths in non OECD Countries by Year",
      x = "Year",
      y = "Total Death",
      color = "Armed Conflict"
    ) + theme_minimal() +
  theme(
    text = element_text(size=8)
  )
```

Table 20 Trends in Total Deaths in non OECD Countries by Year



Summary

Final data: From Table 1-4, we can see that all 4 mortality rates seemed to decrease over the years, and that countries with armed conflict seemed to have higher rates compared to countries without armed conflict. From table 5, we can see that countries with armed conflicts have higher total death counts compared to the countries without armed conflicts. Table 5 shows a clearer distinction between two groups.

Filtered data: I excluded countries with 3 highest total death counts for each year, then repeated the same process for the Table 1-5. Table 6-10 doesn't seem very different from Table 1-5.

OECD vs non OECD countries: While all 4 mortality rates seem to decrease over the years in both groups, OECD countries seem to have much lower mortality rates regardless of the presence of armed conflicts.