CHL8010: Statistical Programming and Computation in Health Data

Week 4 In-class Assignment

2024-09-30

```
library(here)
```

```
here() starts at C:/Users/temoo/OneDrive/Desktop/Uni/Year MPH 1/Year 2/Stat computation/Armed
```

```
library(ggcorrplot)
```

```
Loading required package: ggplot2
```

```
library(ggplot2)
library(dplyr)
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```
source(here("R", "merged_dataset.R"))
```

```
[1] "Columns with NA values:"
     gdp1000      popdens        urban     male_edu         temp rainfall1000
          62           20           20           20           20           20
      MarMor      InfMort NeonatalMort   Under5Mort      Drought   Earthquake
         426           20           20           20         3132         3132
# A tibble: 0 x 2
# i 2 variables: ISO <chr>, count <int>
```

Perfect your GitHub repo

Some of you may still need to organize your GitHub repo. Use this time to do that. When you are confident with your repo, let me know – I will try to reproduce your code.

Your final data should have the following variables (you might have slightly different variable names).

```
finaldata <- read.csv(here("data", "analytical", "finaldata.csv"), header = TRUE)
names(finaldata)
```

```
 [1] "country_name" "ISO"          "region"       "Year"         "gdp1000"
 [6] "OECD"         "OECD2023"     "popdens"      "urban"        "agedep"
[11] "male_edu"     "temp"         "rainfall1000" "MarMor"       "InfMort"
[16] "NeonatalMort" "Under5Mort"   "total_deaths" "conflict"     "Drought"
[21] "Earthquake"
```

Observations from Canada should look like this...

```
finaldata %>%
  dplyr::filter(country_name == "Canada")
```

```
   country_name ISO           region Year  gdp1000 OECD OECD2023  popdens
1        Canada CAN Northern America 2000 24.27100    1        1 66.19704
2        Canada CAN Northern America 2001 23.82206    1        1 66.45361
3        Canada CAN Northern America 2002 24.25534    1        1 66.71112
4        Canada CAN Northern America 2003 28.30046    1        1 66.96384
5        Canada CAN Northern America 2004 32.14368    1        1 67.21715
6        Canada CAN Northern America 2005 36.38251    1        1 67.47283
7        Canada CAN Northern America 2006 40.50406    1        1 67.73674
8        Canada CAN Northern America 2007 44.65990    1        1 67.99444
9        Canada CAN Northern America 2008 46.71051    1        1 68.25765
10       Canada CAN Northern America 2009 40.87631    1        1 68.53354
```

```
11       Canada CAN Northern America 2010 47.56208    1        1 68.80739
12       Canada CAN Northern America 2011 52.22370    1        1 69.04842
13       Canada CAN Northern America 2012 52.66909    1        1 69.27604
14       Canada CAN Northern America 2013 52.63517    1        1 69.50772
15       Canada CAN Northern America 2014 50.95600    1        1 69.76876
16       Canada CAN Northern America 2015 43.59614    1        1 69.98853
17       Canada CAN Northern America 2016 42.31560    1        1 70.21484
18       Canada CAN Northern America 2017 45.12943    1        1 70.40863
19       Canada CAN Northern America 2018 46.54864    1        1 70.63614
20       Canada CAN Northern America 2019 46.32867    1        1 70.83794
      urban   agedep male_edu     temp rainfall1000 MarMor InfMort NeonatalMort
1  56.14335 46.34463 12.30281 5.486244    0.9971559      9     5.3          3.8
2  56.40270 45.89632 12.35258 6.469105    0.8644873     10     5.3          3.8
3  56.67093 45.46660 12.40182 5.979147    0.9460938     10     5.3          3.9
4  56.94365 45.07468 12.45053 5.416964    1.0189234     10     5.3          3.9
5  57.20020 44.67374 12.49870 5.556961    1.0008237     10     5.3          3.9
6  57.41671 44.26641 12.54635 6.187472    1.0367199     11     5.2          3.9
7  57.59143 43.96370 12.59349 6.895084    1.0917386     11     5.2          3.9
8  57.75691 43.83612 12.64015 5.900051    1.0134091     11     5.1          3.8
9  57.97905 43.85426 12.68634 5.650118    1.0693435     12     5.1          3.8
10 58.24228 43.94937 12.73207 5.398867    0.9928497     12     5.0          3.8
11 58.52809 44.13587 12.77735 6.781766    1.0379754     11     5.0          3.8
12 58.81437 44.53578 12.82218 6.269133    1.1343442     11     4.9          3.7
13 59.05573 45.18393 12.86660 7.249497    0.9747708     11     4.9          3.7
14 59.19713 45.95404 12.91059 5.954381    1.0282075     11     4.8          3.6
15 59.30361 46.75493 12.95414 5.584650    1.0377695     11     4.7          3.6
16 59.42627 47.59164 12.99723 6.436884    0.9632446     11     4.7          3.6
17 59.50521 48.41410 13.03988 7.184514    0.9677826     10     4.6          3.5
18 59.59325 49.14806 13.08210 6.539669    1.0995322     10     4.6          3.4
19 59.68433 49.80166 13.12388 6.539677    1.0991469     NA     4.5          3.3
20 59.75984 50.47739 13.16522 6.539633    1.0987523     NA     4.4          3.3
   Under5Mort total_deaths conflict Drought Earthquake
1         6.2           11        0       0          0
2         6.2           23        0       0          0
3         6.2            1        0       0          0
4         6.2            0        0       0          0
5         6.1            0        0       0          0
6         6.1            0        0       0          0
7         6.0            0        0       0          0
8         6.0            0        0       0          0
9         5.9            0        0       0          0
10        5.8            0        0       0          0
11        5.7            0        0       0          0
```

12	5.7	0	0	0	0
13	5.6	0	0	0	0
14	5.5	0	0	0	0
15	5.4	0	0	0	0
16	5.4	0	0	0	0
17	5.3	0	0	0	0
18	5.2	0	0	0	0
19	5.1	0	0	0	0
20	5.1	0	0	0	0

Observations from Ecuador should look like this...

```
finaldata %>%
  dplyr::filter(country_name == "Ecuador")
```

	country_name	ISO	region	Year	gdp1000	OECD	OECD2023
1	Ecuador	ECU	Latin America and the Caribbean	2000	1.451531	0	0
2	Ecuador	ECU	Latin America and the Caribbean	2001	1.904814	0	0
3	Ecuador	ECU	Latin America and the Caribbean	2002	2.184209	0	0
4	Ecuador	ECU	Latin America and the Caribbean	2003	2.438344	0	0
5	Ecuador	ECU	Latin America and the Caribbean	2004	2.703566	0	0
6	Ecuador	ECU	Latin America and the Caribbean	2005	3.014310	0	0
7	Ecuador	ECU	Latin America and the Caribbean	2006	3.340841	0	0
8	Ecuador	ECU	Latin America and the Caribbean	2007	3.579032	0	0
9	Ecuador	ECU	Latin America and the Caribbean	2008	4.260433	0	0
10	Ecuador	ECU	Latin America and the Caribbean	2009	4.240703	0	0
11	Ecuador	ECU	Latin America and the Caribbean	2010	4.640246	0	0
12	Ecuador	ECU	Latin America and the Caribbean	2011	5.202656	0	0
13	Ecuador	ECU	Latin America and the Caribbean	2012	5.678456	0	0
14	Ecuador	ECU	Latin America and the Caribbean	2013	6.050355	0	0
15	Ecuador	ECU	Latin America and the Caribbean	2014	6.374631	0	0
16	Ecuador	ECU	Latin America and the Caribbean	2015	6.130587	0	0
17	Ecuador	ECU	Latin America and the Caribbean	2016	6.079089	0	0
18	Ecuador	ECU	Latin America and the Caribbean	2017	6.246404	0	0
19	Ecuador	ECU	Latin America and the Caribbean	2018	6.321349	0	0
20	Ecuador	ECU	Latin America and the Caribbean	2019	6.233258	0	0

	popdens	urban	agedep	male_edu	temp	rainfall1000	MarMor	InfMort
1	23.27432	36.19963	67.44216	7.738627	19.54855	1.4201653	122	24.7
2	23.39372	36.67994	66.57356	7.843942	19.66622	1.1667746	117	23.4
3	23.52087	37.08903	65.65488	7.949449	20.24695	1.4577981	110	22.4
4	23.58358	37.23792	64.71472	8.055240	20.05016	1.5781807	100	21.5
5	38.43743	37.39268	63.78049	8.161433	20.10136	1.0683450	94	20.7

```
6  38.55361 37.36968 62.86530 8.268176 19.88163    0.8555447     94    19.9
7  38.65018 37.47567 61.97042 8.375587 20.07087    1.1114502     90    19.2
8  38.76505 37.68172 61.11422 8.483729 19.49536    1.0899082     85    18.5
9  38.83977 37.67445 60.31015 8.592603 19.85711    1.6184816     82    17.7
10 38.92613 37.39437 59.55262 8.702180 20.39298    1.0870796     80    17.0
11 39.03066 37.26838 58.83793 8.812409 20.11160    1.7045703     78    16.3
12 39.09586 37.61553 58.16553 8.923172 19.86633    1.4518388     76    15.6
13 39.13343 38.00733 57.51051 9.034284 20.19000    1.7520003     71    14.9
14 39.18619 38.22511 56.84804 9.145523 19.85177    1.3735605     67    14.3
15 39.27871 38.12421 56.17001 9.256679 20.42252    1.2572257     65    13.7
16 39.38824 38.15633 55.46511 9.367582 20.95595    1.7284273     63    13.2
17 39.46201 38.45745 54.73369 9.478071 20.77476    1.3168761     61    12.8
18 39.53609 38.65993 53.99096 9.587993 20.53262    1.9544485     59    12.4
19 39.58380 38.87253 53.12249 9.697221 20.53714    1.9573265     NA    12.0
20 39.75109 39.05144 52.29278 9.805670 20.54169    1.9602443     NA    11.6
   NeonatalMort Under5Mort total_deaths conflict Drought Earthquake
1          14.1       29.5            0        0       0          0
2          13.4       28.0            0        0       0          0
3          12.7       26.6            2        0       0          0
4          12.1       25.4            0        0       0          0
5          11.6       24.4           26        1       0          0
6          11.1       23.5            0        0       0          0
7          10.6       22.6            0        0       0          0
8          10.2       21.7            0        0       0          0
9           9.7       20.8            0        0       0          0
10          9.3       19.9           25        1       1          0
11          8.9       19.0            0        0       0          0
12          8.5       18.1            0        0       0          0
13          8.1       17.3            0        0       0          0
14          7.8       16.6            0        0       1          0
15          7.5       15.9            0        0       0          1
16          7.3       15.4            0        0       0          0
17          7.1       14.8            0        0       0          1
18          6.9       14.4            0        0       0          0
19          6.9       13.9            0        0       0          0
20          6.8       13.4            0        0       0          1
```

Exploratory data analysis

Use the rest of the class time to explore the final data that will be used for analysis starting next week. At the end of the class, write a summary of your findings and push your **Quarto document (pdf)** to your repo.

```
summary(finaldata)
```

```
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         MarMor          InfMort        NeonatalMort
Min.   :0.01993   Min.   :   2.0   Min.   :  1.60   Min.   : 0.80
1st Qu.:0.59146   1st Qu.:  17.0   1st Qu.:  7.60   1st Qu.: 4.90
Median :1.01288   Median :  66.0   Median : 18.90   Median :12.10
Mean   :1.20216   Mean   : 210.6   Mean   : 28.90   Mean   :16.18
3rd Qu.:1.68706   3rd Qu.: 299.8   3rd Qu.: 44.52   3rd Qu.:25.32
Max.   :4.71081   Max.   :2480.0   Max.   :138.10   Max.   :60.90
NA's   :20        NA's   :426      NA's   :20       NA's   :20
  Under5Mort      total_deaths        conflict         Drought
Min.   :  2.00   Min.   :    0.0   Min.   :0.0000   Min.   :0.00000
1st Qu.:  9.00   1st Qu.:    0.0   1st Qu.:0.0000   1st Qu.:0.00000
Median : 22.20   Median :    0.0   Median :0.0000   Median :0.00000
Mean   : 40.50   Mean   :  361.1   Mean   :0.1892   Mean   :0.08737
3rd Qu.: 61.33   3rd Qu.:    2.0   3rd Qu.:0.0000   3rd Qu.:0.00000
Max.   :224.90   Max.   :78644.0   Max.   :1.0000   Max.   :1.00000
NA's   :20
```

```
   Earthquake
 Min.   :0.00000
 1st Qu.:0.00000
 Median :0.00000
 Mean   :0.08333
 3rd Qu.:0.00000
 Max.   :1.00000
```

```r
# Check for missing values
colSums(is.na(finaldata))
```

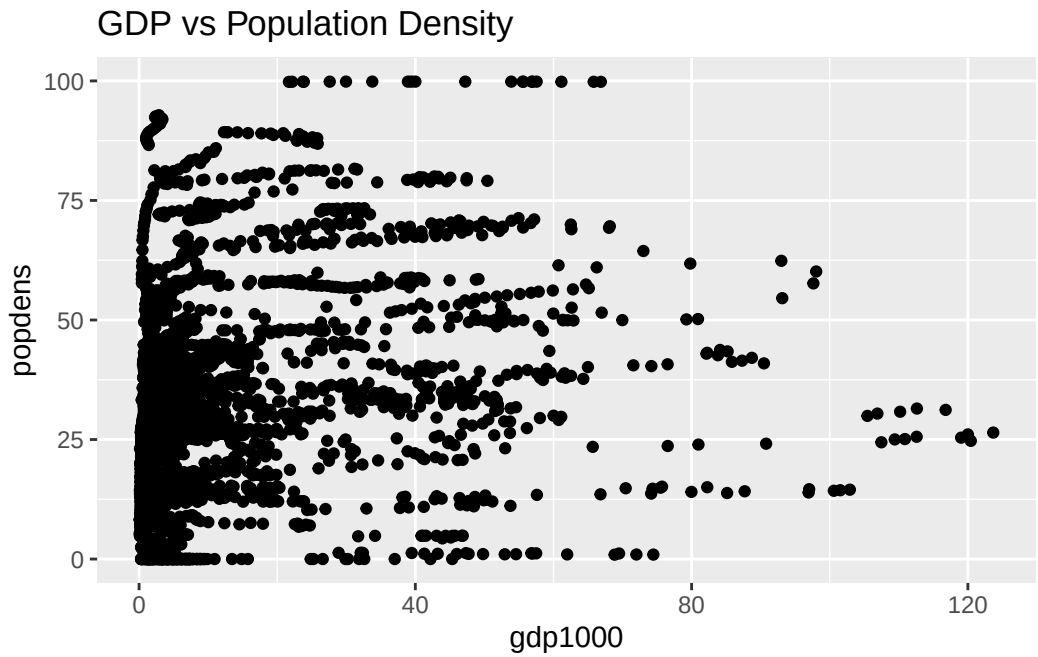
```
country_name          ISO       region         Year      gdp1000         OECD
           0            0            0            0           62            0
    OECD2023      popdens        urban       agedep     male_edu         temp
           0           20           20            0           20           20
rainfall1000       MarMor      InfMort NeonatalMort   Under5Mort total_deaths
          20          426           20           20           20            0
    conflict      Drought   Earthquake
           0            0            0
```

gdp1000, popdens, urban, male_edu, temp, rainfall1000, MarMor, InfMort, NeonatalMort all have missing data

MarMor has a lot of missing data

```r
#Bivariate analysis

#GDP and Population density
ggplot(finaldata, aes(x=gdp1000, y=popdens)) +
  geom_point() +
  labs(title="GDP vs Population Density")
```

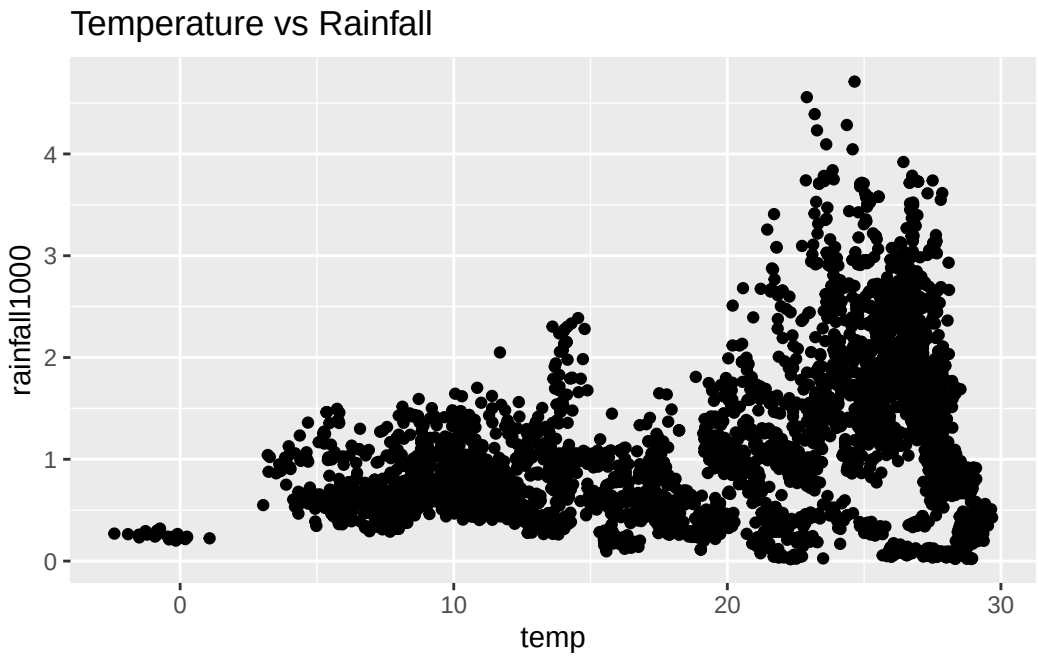
```
Warning: Removed 82 rows containing missing values or values outside the scale range
(`geom_point()`).
```




```
#note missing values were removed
```

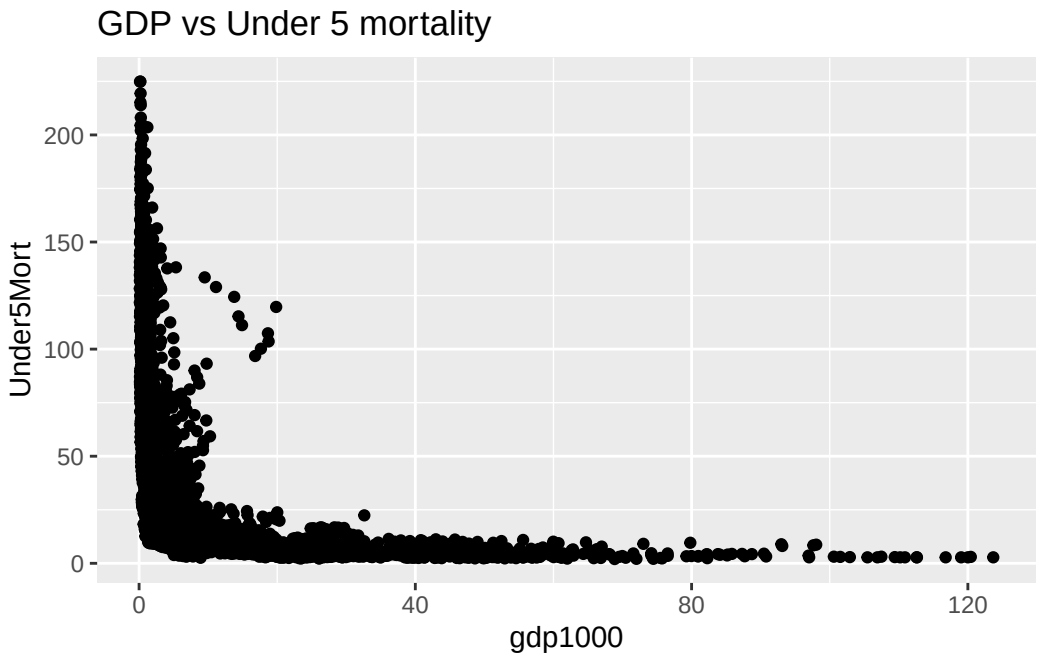
```
#Bivariate analysis

#temp vs. rainfall1000
ggplot(finaldata, aes(x=temp, y=rainfall1000)) +
  geom_point() +
  labs(title="Temperature vs Rainfall")
```

```
Warning: Removed 20 rows containing missing values or values outside the scale range
(`geom_point()`).
```



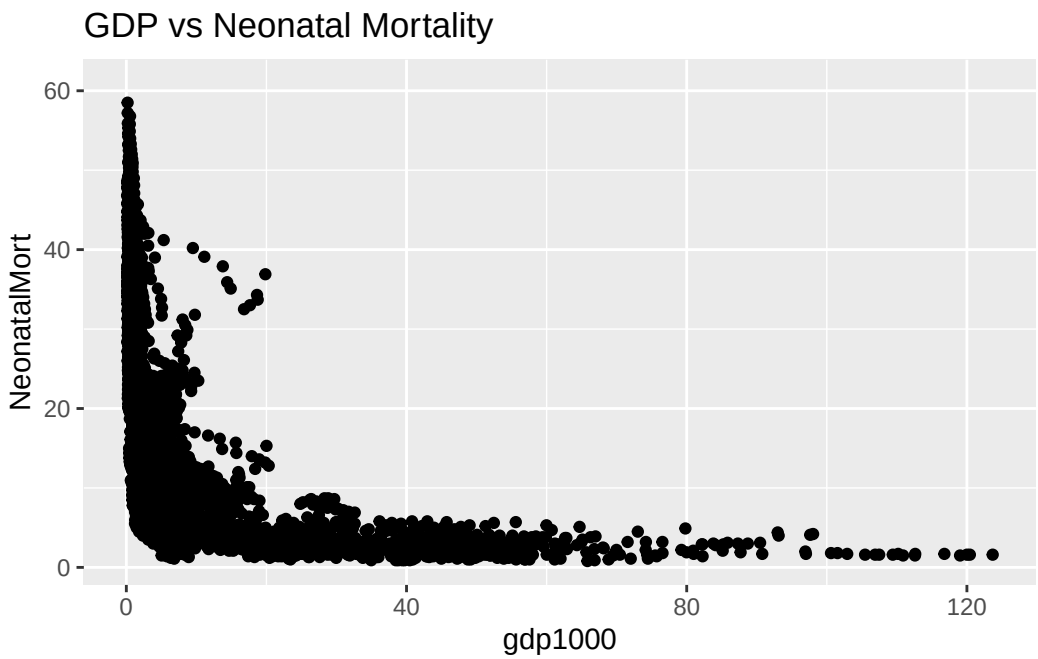
Lower temperature countries have less rainfall whereas for higher temperature, it varies

```
#Bivariate analysis

#gdp1000 vs. Under5Mort
ggplot(finaldata, aes(x=gdp1000, y=Under5Mort)) +
  geom_point() +
  labs(title="GDP vs Under 5 mortality")
```



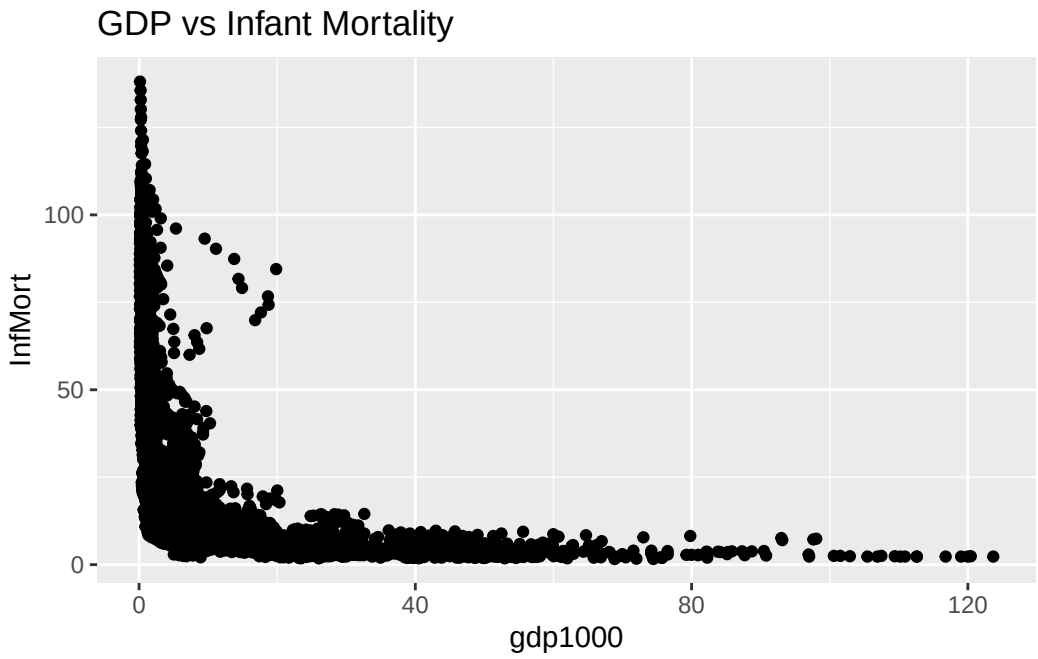
Countries with low GDP have substantially greater mortality rates for children under 5.

```
#Bivariate analysis

#gdp1000 vs. NeonatalMort
ggplot(finaldata, aes(x=gdp1000, y=NeonatalMort)) +
  geom_point() +
  labs(title="GDP vs Neonatal Mortality")
```



Countries with lower GDP have substantially higher neonatal mortality rates

```
#Bivariate analysis

#gdp1000 vs. InfMort
ggplot(finaldata, aes(x=gdp1000, y=InfMort)) +
  geom_point() +
  labs(title="GDP vs Infant Mortality")
```



Countries with lower GDP have substantially higher infant mortality rates