**PROGRAMMING TOOLS AND TECHNOLOGIES FOR DATA SCIENCE**

2020 – 2021

# EXPLORATORY DATA ANALYSIS USING R

**MSc EDEM**
**Tryfonopoulos Dimitrios**
**340037**
**trif.dimitris@gmail.com**

**R CODE**

## Figures and Analysis

### 1. World Analysis

In the following part an extensive worldwide analysis is performed using COVID-19 data for the year 2020. The dataset was imported from a saved file containing data until the 31 December 2020. Another file was used to match the countries with the belonged continent. Both of them are attached. In the 1st part we try to follow the instructions in the exercise to bring the Data Set in the needed format. Also some changes in the Country names were performed in order to match the other datasets that are used to extract the needed information for the figures. A screenshot of the final dataset is attached.

```
library(data.table);
library(lubridate);
library(rworldmap);
library(tmap);
library(ggplot2);
library(grid);
library(dplyr);
library(tidyr);
library(ggrepel);
library(tidyverse);
library(scales);



#Dataset Saved in documents until 31/12/2020
Covid_1 = fread('C:/Users/DTryfonopoulos/Downloads/global_cases_covid19.csv')
Covid_2 = fread('C:/Users/DTryfonopoulos/Downloads/global_deaths_covid19.csv')

numCountries = length(unique(Covid_1$Country))
numDays = length(unique(Covid_1$date))
# 1.Remove columns with names Province, State, Lat and Long
Covid_2[, c("Province/State", "Lat","Long"):=NULL]
Covid_1[, c("Province/State","Lat","Long"):=NULL]

# 2.Convert data from wide to long format
Covid_2 = melt(Covid_2)
Covid_1 = melt(Covid_1)

# 3.Rename variable Country/Region to Country
setnames(Covid_1, 'Country/Region','Country')
setnames(Covid_2, 'Country/Region','Country')

# 4.Name the variable with the cumulative confirmed cases as confirmed and
# the variable with the cumulative number of deaths as deaths
setnames(Covid_1, 'value','confirmed')
setnames(Covid_2, 'value','deaths')

setnames(Covid_1, 'variable','date')
setnames(Covid_2, 'variable','date')

# 5.Convert the variable date from character to a date object (mdy()).
#library(lubridate)
Covid_1$date = mdy(Covid_1$date)
Covid_2$date = mdy(Covid_2$date)

# 6.Group by coutry and date
Covid_1 <- Covid_1[,lapply(.SD,sum),
```

```
                  by = .(Country,date),.SDcols = c('confirmed')]
Covid_2 <- Covid_2[,lapply(.SD,sum),
                  by = .(Country,date),.SDcols = c('deaths')]

# 7.Merge the 2 datasets into one
Covid_All = merge(Covid_1,Covid_2)

# 8.Calculate counts (confirmed and deaths) for the whole world.
#All Confirmed Cases & Deaths for each day
totalPday = Covid_All[,lapply(.SD,sum),
                      by = .(date),.SDcols = c('confirmed','deaths')]

#Dataset with variables in q10
TheDataset = merge(Covid_All,totalPday, by='date')

# 9.Sort again by Country and date
answer_9 = Covid_All[order(Country,date),]

# 10. Create: confirmed.ind & deaths.inc with the daily confirmed cases
# and daily deaths respectively  (lag()?)

namesOld =c('confirmed.x','deaths.x', 'confirmed.y', 'deaths.y')
namesNew = c('confirmed','deaths', 'confirmed.ind', 'deaths.inc')

setnames(TheDataset, namesOld,namesNew)


NewDataset= TheDataset
NewDataset[Country=='United States of America']$Country= "United States"
NewDataset[Country=='North Macedonia']$Country= "Macedonia"
NewDataset[Country=='Czechia']$Country = 'Czech Republic'

#############################################################################
# Match Countries with Continents (CSV downladed from the web)
continents = fread('C:/Users/DTryfonopoulos/Downloads/CountriesContinents.csv')
Country = data.frame(t(do.call("cbind",
                               strsplit(as.character(continents$Country_Name),
                                                ",", fixed = TRUE))))
continents$Country = data.frame(Country$X1)
continent = select(continents, Continent_Name, Country)
# Remove Turkey from being in Europe and Asia (leave only input in Asia)
continent=continent[-c(235),]
continent[Country=='United States of America']$Country= "United States"

DatasetCont = merge(NewDataset, continent, by='Country')

#############################################################################
#############################################################################

# Create Column Deaths & Confirmed Cases per day
DatasetCont$DailyConfirmed = DatasetCont$confirmed -
  lag(DatasetCont$confirmed,1)
DatasetCont$DailyDeaths = DatasetCont$deaths - lag(DatasetCont$deaths,1)

# Deaths & Confirmed Cases  Replace NA and <0 Numbers
DatasetCont$'DailyConfirmed'[is.na(DatasetCont$'DailyConfirmed')] = 0
DatasetCont$'DailyConfirmed'[(DatasetCont$'DailyConfirmed')<0] = 0
DatasetCont$'DailyDeaths'[is.na(DatasetCont$'DailyDeaths')] = 0
DatasetCont$'DailyDeaths'[(DatasetCont$'DailyDeaths')<0] = 0
```

```
# Separate DATE (Y-M-D)
DatasetContDATES = separate(DatasetCont, "date", c("Year", "Month", "Day"), sep = "-")
```

```
> DatasetCont
         Country      date confirmed deaths confirmed.ind deaths.inc Continent_Name DailyConfirmed DailyDeaths
    1: Afghanistan 2020-01-22         0      0           555        17          Asia              0           0
    2: Afghanistan 2020-01-23         0      0           654        18          Asia              0           0
    3: Afghanistan 2020-01-24         0      0           941        26          Asia              0           0
    4: Afghanistan 2020-01-25         0      0          1434        42          Asia              0           0
    5: Afghanistan 2020-01-26         0      0          2118        56          Asia              0           0
   ---
60716:    Zimbabwe 2020-12-27     13077    349      80797122   1764955        Africa            114           8
60717:    Zimbabwe 2020-12-28     13148    354      81285853   1774390        Africa             71           5
60718:    Zimbabwe 2020-12-29     13325    359      81951541   1789915        Africa            177           5
60719:    Zimbabwe 2020-12-30     13625    360      82708280   1805008        Africa            300           1
60720:    Zimbabwe 2020-12-31     13867    363      83424446   1818116        Africa            242           3
```

Figure 1: Final Dataset

In the following code I calculated the Confirmed and Death cases per Country

```
# All Conf & Deaths per Country for the whole Year
DatasetCont=as.data.table(DatasetCont)
ConfDeathPerCountry =(DatasetCont[, lapply(.SD,sum),
                                  by = .(Country,Continent_Name ),
                                  .SDcols = c('DailyConfirmed', 'DailyDeaths')])
ConfDeathPerCountry = ConfDeathPerCountry %>%
  rename( AnnualConfirmed = DailyConfirmed ,AnnualDeaths = DailyDeaths)

ConfDeathPerCountryPerMonth = (DatasetContDATES[, lapply(.SD,sum),
                                                by = .(Country,Month ),
                                                .SDcols =
                                                  c('DailyConfirmed', 'DailyDeaths')])
#########################################################################
# Confirmed-Deaths Per Continent

ConfDeathEurope = ConfDeathPerCountry[Continent_Name =='Europe']
ConfDeathAsia = ConfDeathPerCountry[Continent_Name =='Asia']
ConfDeathAfrica = ConfDeathPerCountry[Continent_Name =='Africa']
ConfDeathNAmerica = ConfDeathPerCountry[Continent_Name =='North America']
ConfDeathSAmerica = ConfDeathPerCountry[Continent_Name =='South America']
ConfDeathOceania = ConfDeathPerCountry[Continent_Name =='Oceania']

# TOP 8 Countries/Continent Confirmed % Deaths
#We will keep the top3 and top8 countries

#Europe
TopConfEurope = ConfDeathEurope[order(-AnnualConfirmed)]%>% head(3)
```

```
TopDeathEurope = ConfDeathEurope[order(-AnnualDeaths)]%>% head(3)

TopConfEurope2 = ConfDeathEurope[order(-AnnualConfirmed)]%>% head(8)
TopDeathEurope2 = ConfDeathEurope[order(-AnnualDeaths)]%>% head(8)
#Asia
TopConfAsia = ConfDeathAsia[order(-AnnualConfirmed)]%>% head(3)
TopDeathAsia = ConfDeathAsia[order(-AnnualDeaths)]%>% head(3)

TopConfAsia2 = ConfDeathAsia[order(-AnnualConfirmed)]%>% head(8)
TopDeathAsia2 = ConfDeathAsia[order(-AnnualDeaths)]%>% head(8)
#Africa
TopConfAfrica = ConfDeathAfrica[order(-AnnualConfirmed)]%>% head(3)
TopDeathAfrica = ConfDeathAfrica[order(-AnnualDeaths)]%>% head(3)

TopConfAfrica2 = ConfDeathAfrica[order(-AnnualConfirmed)]%>% head(8)
TopDeathAfrica2 = ConfDeathAfrica[order(-AnnualDeaths)]%>% head(8)
#NAmerica
TopConfNAmerica = ConfDeathNAmerica[order(-AnnualConfirmed)]%>% head(3)
TopDeathNAmerica = ConfDeathNAmerica[order(-AnnualDeaths)]%>% head(3)

TopConfNAmerica2 = ConfDeathNAmerica[order(-AnnualConfirmed)]%>% head(8)
TopDeathNAmerica2 = ConfDeathNAmerica[order(-AnnualDeaths)]%>% head(8)
#SAmerica
TopConfSAmerica = ConfDeathSAmerica[order(-AnnualConfirmed)]%>% head(3)
TopDeathSAmerica = ConfDeathSAmerica[order(-AnnualDeaths)]%>% head(3)

TopConfSAmerica2 = ConfDeathSAmerica[order(-AnnualConfirmed)]%>% head(8)
TopDeathSAmerica2 = ConfDeathSAmerica[order(-AnnualDeaths)]%>% head(8)

#Oceania
TopConfOceania = ConfDeathOceania[order(-AnnualConfirmed)]%>% head(3)
TopDeathOceania = ConfDeathOceania[order(-AnnualDeaths)]%>% head(3)

TopConfOceania2 = ConfDeathOceania[order(-AnnualConfirmed)]%>% head(8)
TopDeathOceania2 = ConfDeathOceania[order(-AnnualDeaths)]%>% head(8)

# TOP 3 Countries - Confirmed Cases
worldTopConf = rbind(TopConfEurope, TopConfAsia, TopConfAfrica, TopConfNAmerica,
                     TopConfSAmerica, TopConfOceania)

# TOP 3 Countries - Deaths Cases
worldTopDeath = rbind(TopDeathEurope, TopDeathAsia, TopDeathAfrica, TopDeathNAmerica,
                      TopDeathSAmerica, TopDeathOceania)

#GRAPH 1 : 3 Top Countries/Continent Conf&Deaths  "Rplot01"
g1=ggplot(worldTopConf, aes(Continent_Name, AnnualConfirmed, size=AnnualDeaths)) +
geom_point(aes(color=Country))+ geom_text_repel( aes(label = AnnualDeaths),angle=270,
                                                 colour='red', hjust='left') +
labs(title = 'Top 3 Conf&Deaths - Countries/Continent Annualy',
subtitle = 'Horizontal Number: Confirmed
     Vertical Number: Deaths ', x= 'Continent', y = ' Annual Confirmed Cases') +
geom_text(aes(label =AnnualConfirmed ),check_overlap = TRUE,hjust='right')
```

In this figure we can observe the top 3 Countries per continent with the Confirmed and Death Cases. The numbers in the graph are referring to the Annual Confirmed (black) and Annual Deaths (red) per country.

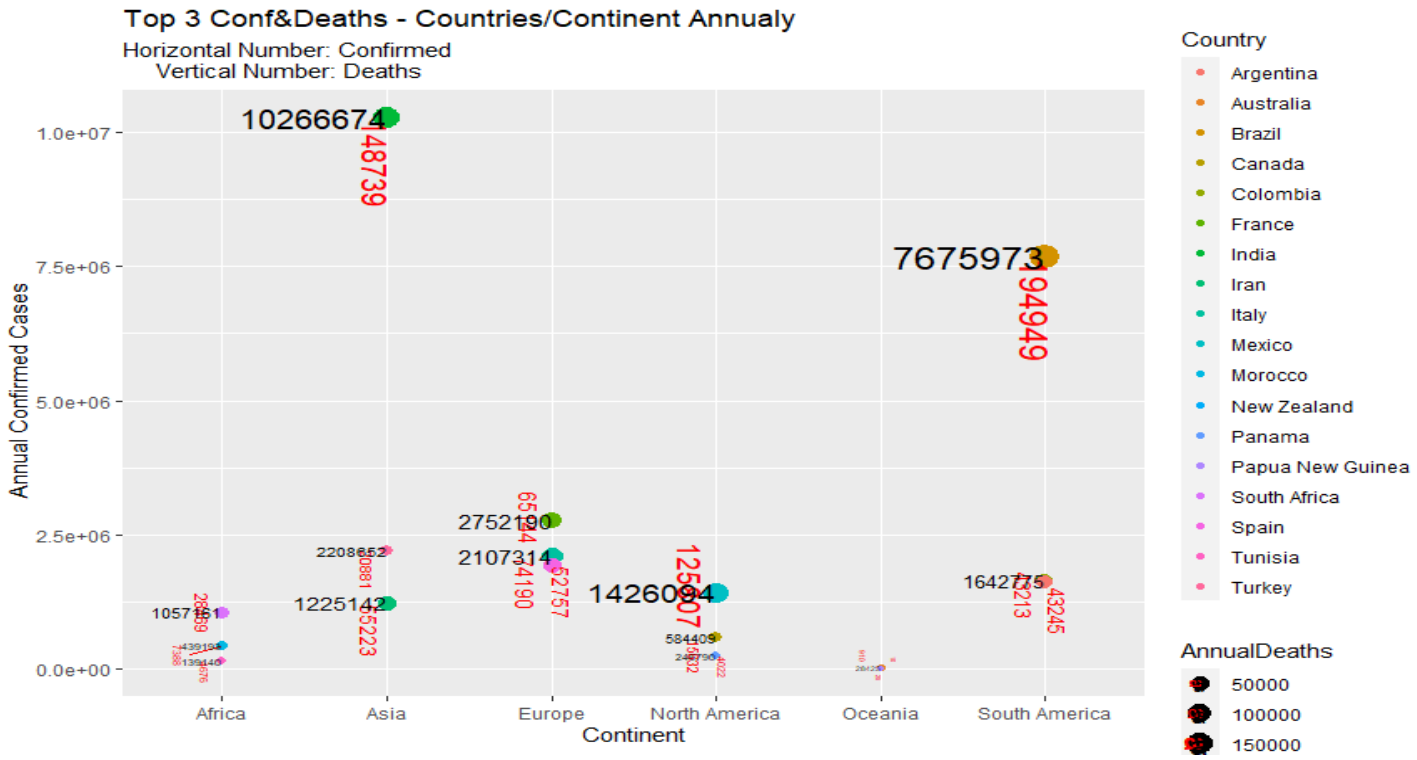


Figure 2: Top 3 Countries per Continent - Confirmed  Death Cases

```
# Top Effected Countries Worldwide
MONTHS= unique(ConfDeathPerCountryPerMonth$Month) # List with all the months

rm(df)
k=1;
Country = vector(mode = "list", length = 12)
DailyConfirmed =vector(mode = "numeric", length = 12)
DailyDeaths = vector(mode = "numeric", length = 12)

for (i in MONTHS){

  Country[k] =ConfDeathPerCountryPerMonth[Month==i][order(-DailyConfirmed)][1]$Country
  DailyConfirmed[k] =
    ConfDeathPerCountryPerMonth[Month==i][order(-DailyConfirmed)][1]$DailyConfirmed
  DailyDeaths[k] =
    ConfDeathPerCountryPerMonth[Month==i][order(-DailyConfirmed)][1]$DailyDeaths
  k=k+1
}

WorldTopConfPerMonth <- data.frame(Country=character(12), DailyConfirmed=numeric(12),
                                   DailyDeaths=numeric(12), stringsAsFactors=FALSE)
WorldTopConfPerMonth$Country = Country
WorldTopConfPerMonth$DailyConfirmed =as.matrix(DailyConfirmed)
WorldTopConfPerMonth$DailyDeaths = DailyDeaths
WorldTopConfPerMonth$Month = MONTHS

WorldTopConfPerMonth = melt(as.data.table(WorldTopConfPerMonth))
dat_long <- WorldTopConfPerMonth %>% gather("Variable", "Value", Month)

#GRAPH_2: World Top Conf&Deaths - Countries Monthy    'Rplot02'
g2 =ggplot(WorldTopConfPerMonth, aes(x=Month, y=value, fill = variable)) +
geom_bar(position = "dodge", stat = "identity") +
geom_label(data = WorldTopConfPerMonth, aes(label = Country), vjust = -0.5)+
```

```
labs(title = "World Top Conf&Deaths - Countries Monthy", subtitle = '2020',
     x = "Month", y = "Cases", color = "Country")+
geom_text(aes(label =value ),check_overlap = TRUE,hjust='bottom')
```

In the next figure we can observe the most affected Countries for each month of 2020

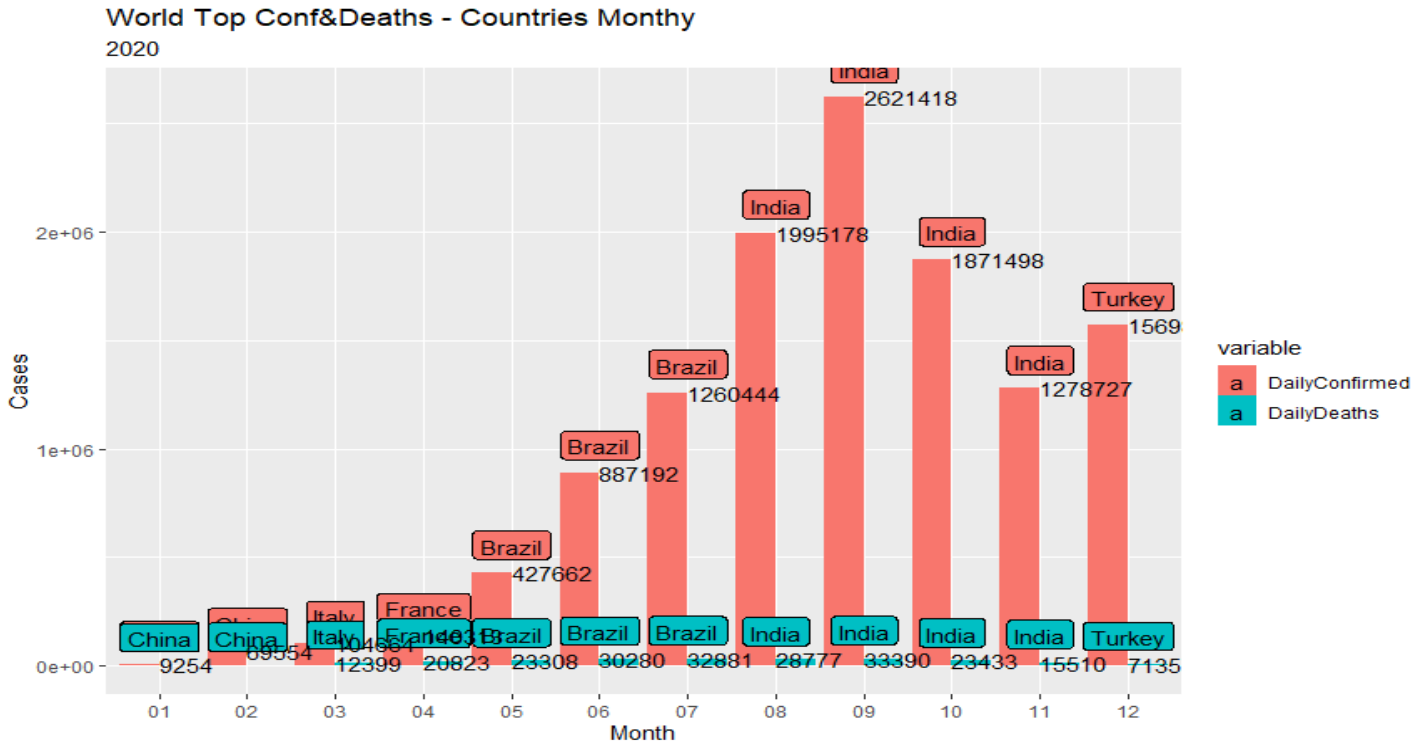


Figure 3: Most Affected Countries for each Month - Confirmed  Death Cases

```
# All Conf & Deaths per Country per Month
ConfDeathPerCountryPerMonth= DatasetContDATES[, lapply(.SD,sum),
                                              by=.(Country, Continent_Name, Month),
                                              .SDcols =
                                                c('DailyConfirmed', 'DailyDeaths')]

#Europe
EuropeMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='Europe']
EuropeMonthly= merge(EuropeMonthlyAll,TopConfEurope2, by='Country' )
# Conf
c_EU=ggplot(EuropeMonthly, aes(x = Month, y=Country)) +
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in Europe per Month')
# Deaths
d_EU=ggplot(EuropeMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyDeaths))+
  labs(title='Death Cases:', subtitle='Top 8 Countries in Europe per Month')
#####################################################################
#Asia
AsiaMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='Asia']
AsiaMonthly= merge(AsiaMonthlyAll,TopConfAsia2, by='Country' )
# Conf
c_AS=ggplot(AsiaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in Asia per Month')
# Deaths
d_AS=ggplot(AsiaMonthly, aes(x = Month, y=Country))+
```

```
  geom_point(aes(col=Country,size=DailyDeaths))+
  labs(title='Deaths Cases:', subtitle='Top 8 Countries in Asia per Month')
#########################################################################
#Africa
AfricaMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='Africa']
AfricaMonthly= merge(AfricaMonthlyAll,TopConfAfrica2, by='Country' )
# Conf
c_AF=ggplot(AfricaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in Africa per Month')
# Deaths
d_AF=ggplot(AfricaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyDeaths)) +
  labs(title='Deaths Cases:', subtitle='Top 8 Countries in Africa per Month')
#########################################################################
#NAmerica
NAmericaMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='North America']
NAmericaMonthly= merge(NAmericaMonthlyAll,TopConfNAmerica2, by='Country' )
# Conf
c_NA=ggplot(NAmericaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in N.America per Month')
# Deaths
d_NA=ggplot(NAmericaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyDeaths)) +
  labs(title='Death Cases:', subtitle='Top 8 Countries in N.America per Month')
#########################################################################
#S America
SAmericaMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='South America']
SAmericaMonthly=merge(SAmericaMonthlyAll,TopConfSAmerica2, by='Country' )
# Conf
c_SA=ggplot(SAmericaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in S.America per Month')
# Deaths
d_SA=ggplot(SAmericaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyDeaths))+
  labs(title='Death Cases:', subtitle='Top 8 Countries in S.America per Month')
#########################################################################
#Oceania
OceaniaMonthlyAll=ConfDeathPerCountryPerMonth[Continent_Name=='Oceania']
OceaniaMonthly=merge(OceaniaMonthlyAll,TopConfOceania2, by='Country' )
# Conf
c_OC=ggplot(OceaniaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyConfirmed))+
  labs(title='Confirmed Cases:', subtitle='Top 8 Countries in Oceania per Month')
# Deaths
d_OC=ggplot(OceaniaMonthly, aes(x = Month, y=Country))+
  geom_point(aes(col=Country,size=DailyDeaths))+
  labs(title='Death Cases:', subtitle='Top 8 Countries in Oceania per Month')
```

In the above code you can reproduce all the figures for the Top 8 affected Countries per continent for both the Confirmed and the Death Cases. As we can see in Europe's case, there are 2 waves of the virus starting more or less at very closed time points for all the Top affected Countries. Also the death cases are increased for the second wave for all the countries apart from Italy, Spain and France that they faced similar deaths in both periods. On the other hand, the case of North America showed the all the countries had a later pandemic start comparing with Europe, but the same high Confirmed and Death cases were present from the beginning of the pandemic until the end of the year. The most affected countries were mainly United States and Mexico The figures for the rest of the countries are not attached for limitations in the final document size.

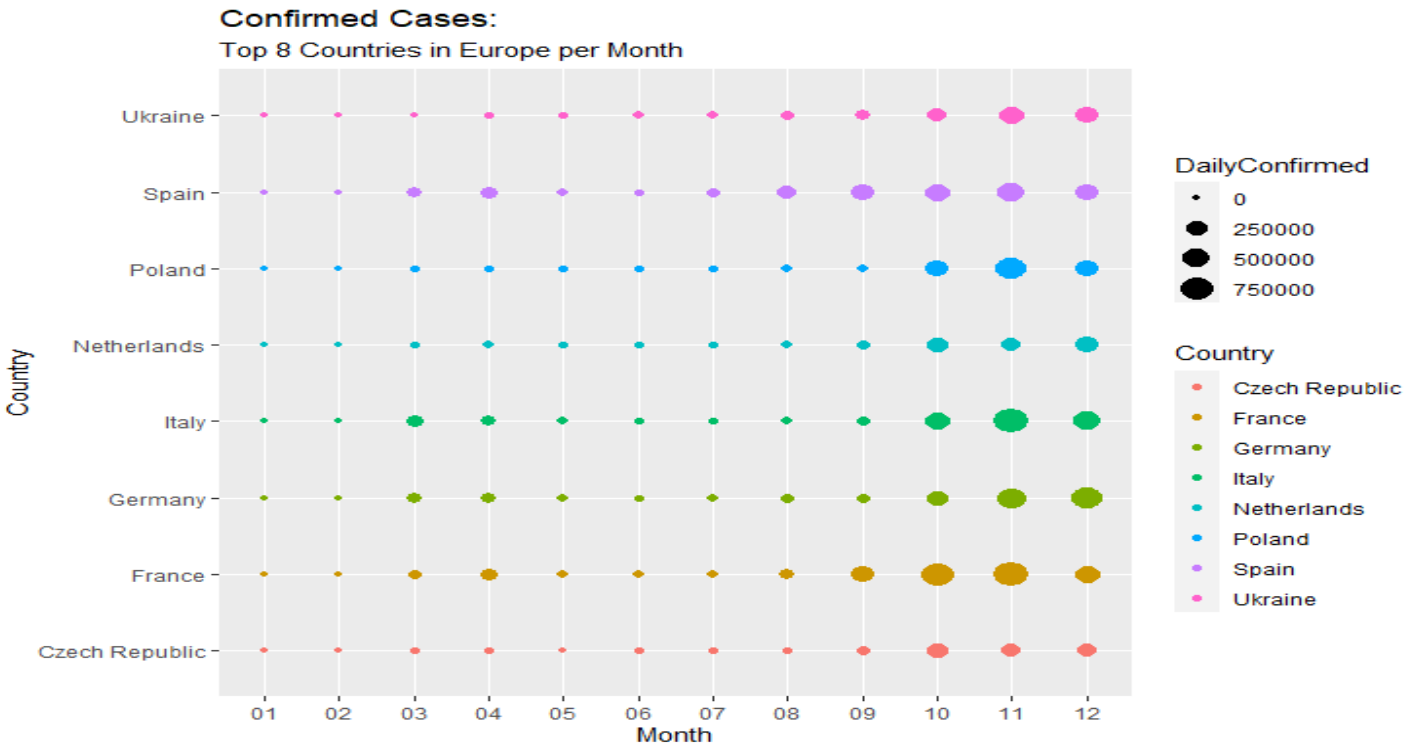


Figure 4: EUROPE Confirmed Cases

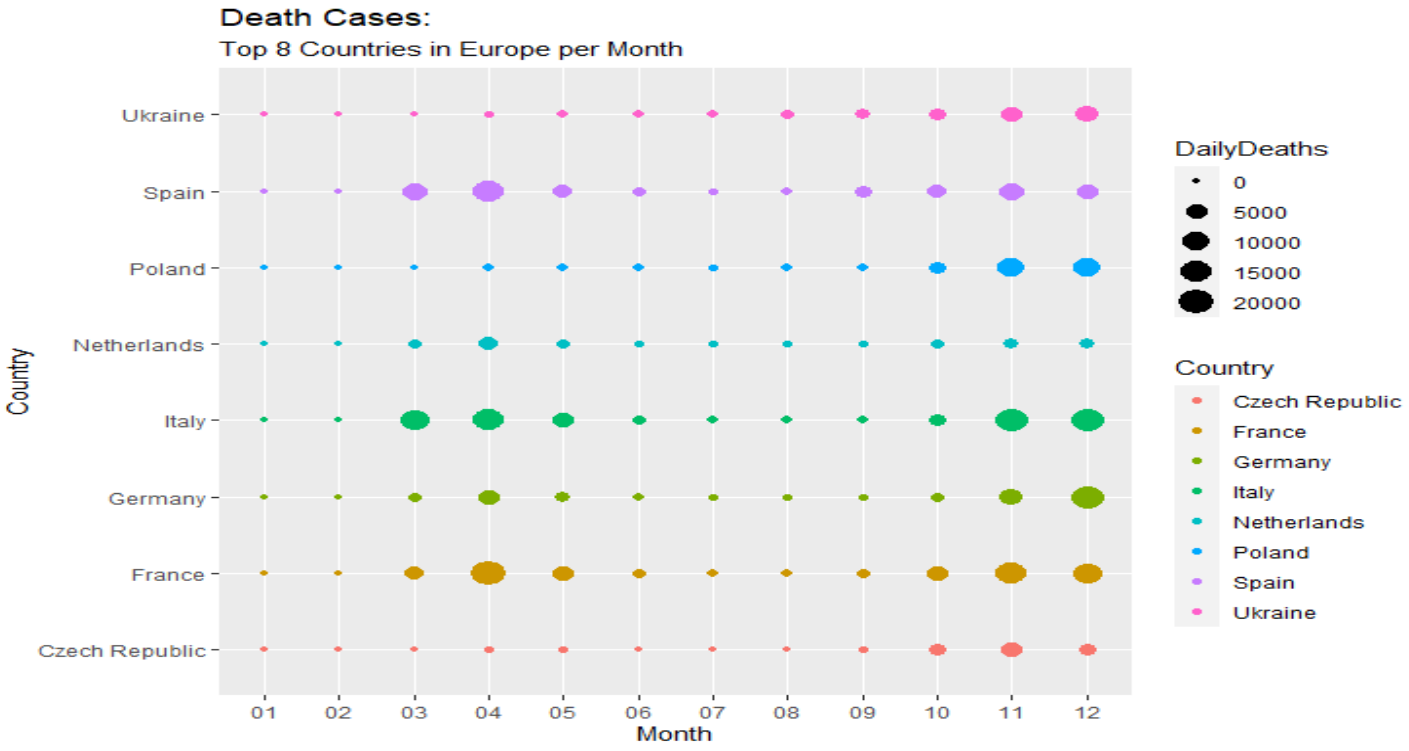


Figure 5: EUROPE Death Cases

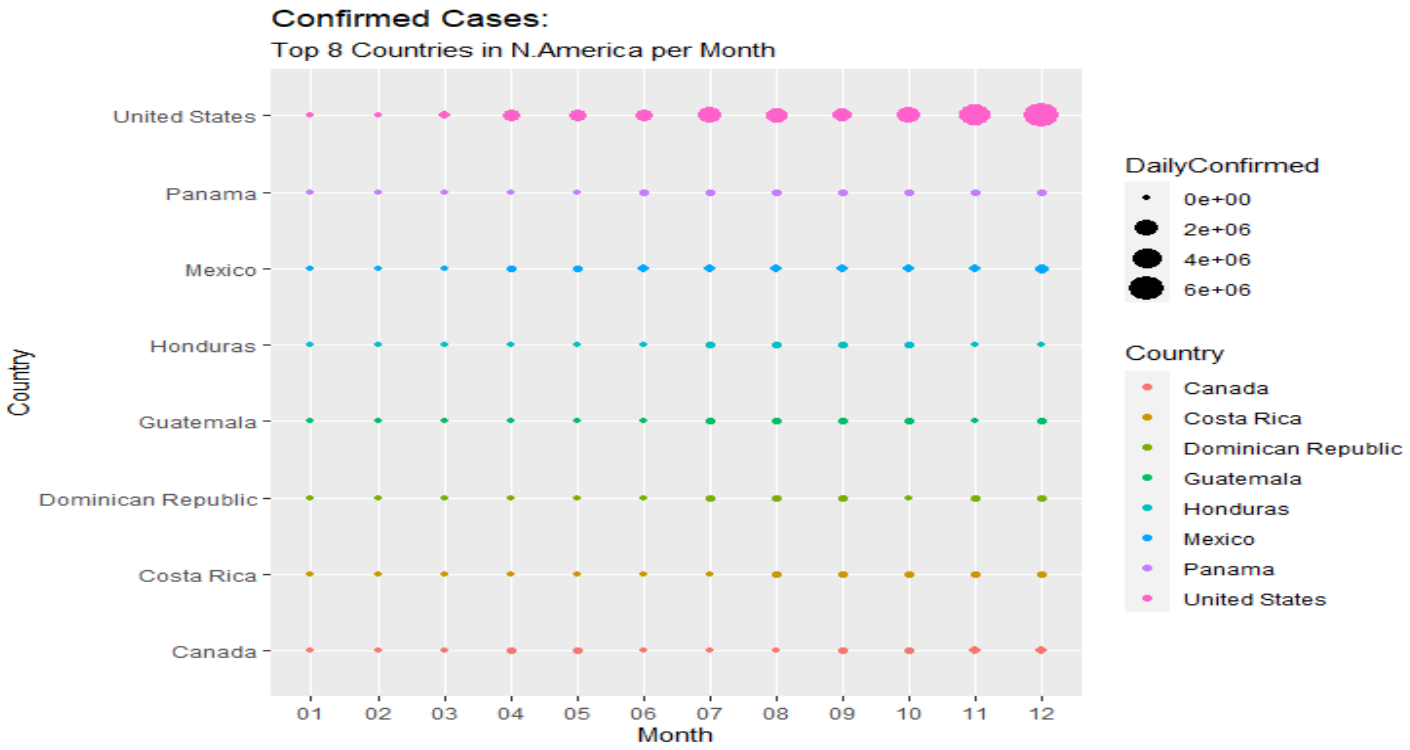


Figure 6: NORTH AMERICA Confirmed Cases

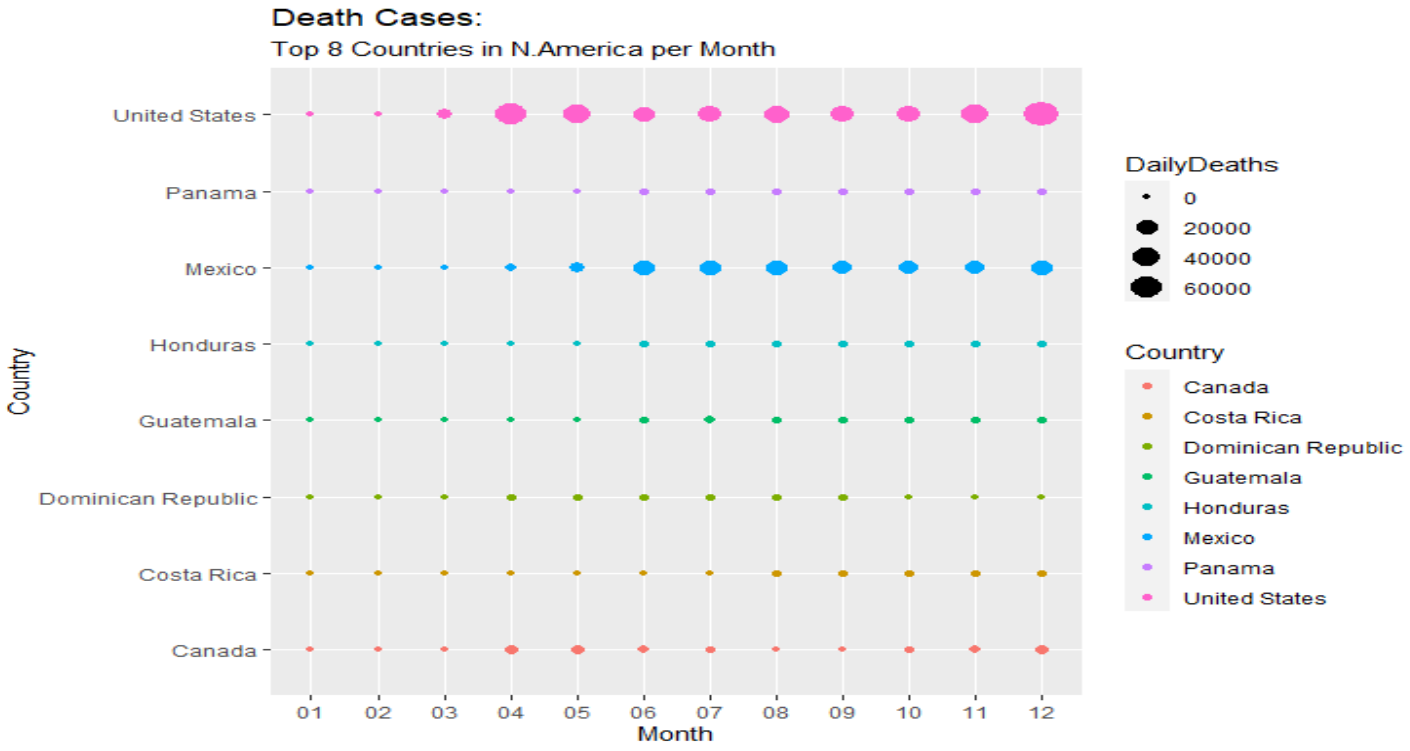


Figure 7: NORTH AMERICA Death Cases

```
\vspace{0.75cm}
# Create Maps with data
allconts = unique(DatasetCont$Continent_Name)
for (j in allconts){

  worldMap <- getMap()
```

```
  # Find the Countries of each Continent
  EuropeCountries = unique(DatasetCont[c(Continent_Name==j)]$Country)
  indEU <- which(worldMap$NAME%in%EuropeCountries)


  # Keep The coordinates for each Country in the Map
  europeCoords <- lapply(indEU, function(i){
    df <- data.frame(worldMap@polygons[[i]]@Polygons[[1]]@coords)
    df$region =as.character(worldMap$NAME[i])
    colnames(df) <- list("long", "lat", "region")
    return(df)
  })

  europeCoords <- do.call("rbind", europeCoords)
  ######################################################################
  # Create data.frame for Confirmed and Deaths
  AnnualConfirmed = ConfDeathPerCountry[Continent_Name==j]$AnnualConfirmed
  AnnualDeaths = ConfDeathPerCountry[Continent_Name==j]$AnnualDeaths

  ######
  europeanUnionTable <- data.frame(country = EuropeCountries,
                                   AnnualConfirmed, AnnualDeaths)
  europeanUnionTable=europeanUnionTable %>% rename(region = country,)

  europeCoords = merge(europeCoords,europeanUnionTable, by= 'region')

  # Change fill AnnualDeaths to calculate deaths
  P <- ggplot() + geom_polygon(data = europeCoords, aes(x = long, y = lat,
                                                        group = region,
                                                        fill = AnnualConfirmed),
                               colour = "black", size = 0.1)

  P<- P + labs(title="Annual Confirmed Cases")
  #P<- P + labs(title="Annual Death Cases")


  #These Colors for Confirmed
  P <- P + scale_fill_gradient(name = "Annual Confirmed",
                               high = "#FF0000FF", low = "#FFFF00FF", na.value ="grey50",
                               labels=comma)

  #These Colors for Deaths
  #P <- P + scale_fill_gradient(name = "Annual DeaTHS",
   #                            low = "#FFFFFF", high = "#000000", na.value = "grey50",
    #                           labels=comma)


  P <- P + theme(axis.text.x = element_blank(),
    axis.text.y = element_blank(), axis.ticks.x = element_blank(),
    axis.ticks.y = element_blank(), axis.title = element_blank(),
    plot.margin = unit(0 * c(-1.5, -1.5, -1.5, -1.5), "lines"))
  assign(paste("Map_C_", j, sep = ""), P)
}
```

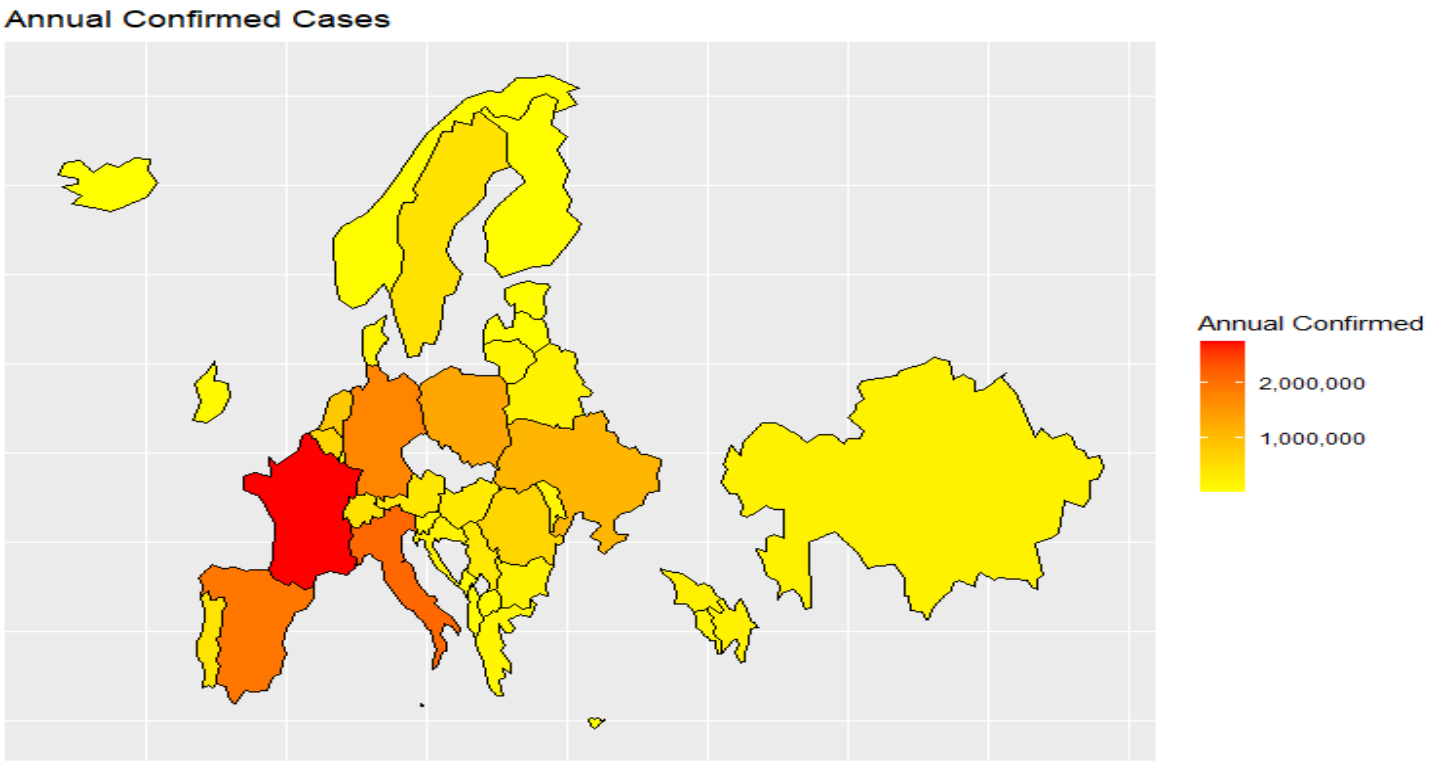


Figure 8: EUROPE MAP Confirmed Cases

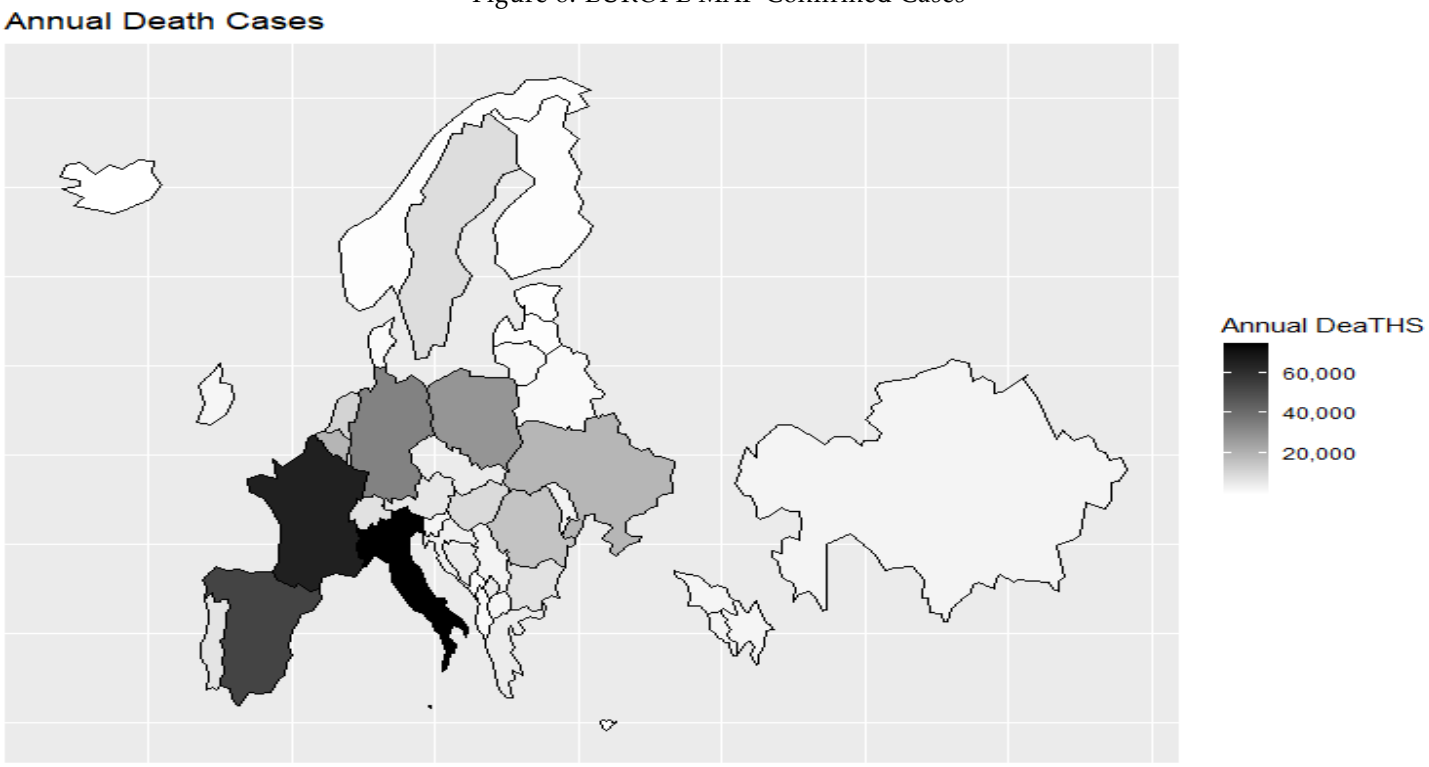


Figure 9: EUROPE MAP Death Cases

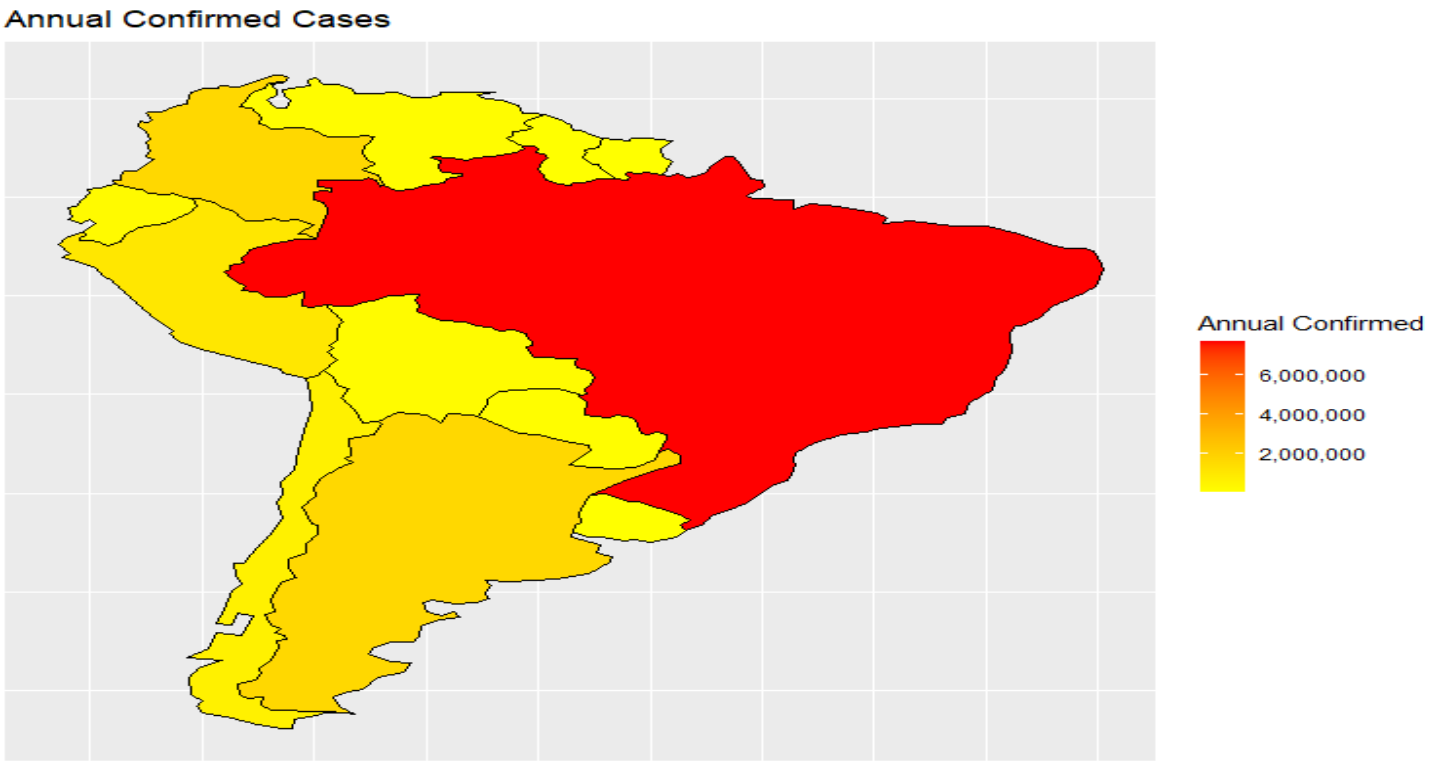


Figure 10: SOUTH AMERICA MAP Confirmed Cases

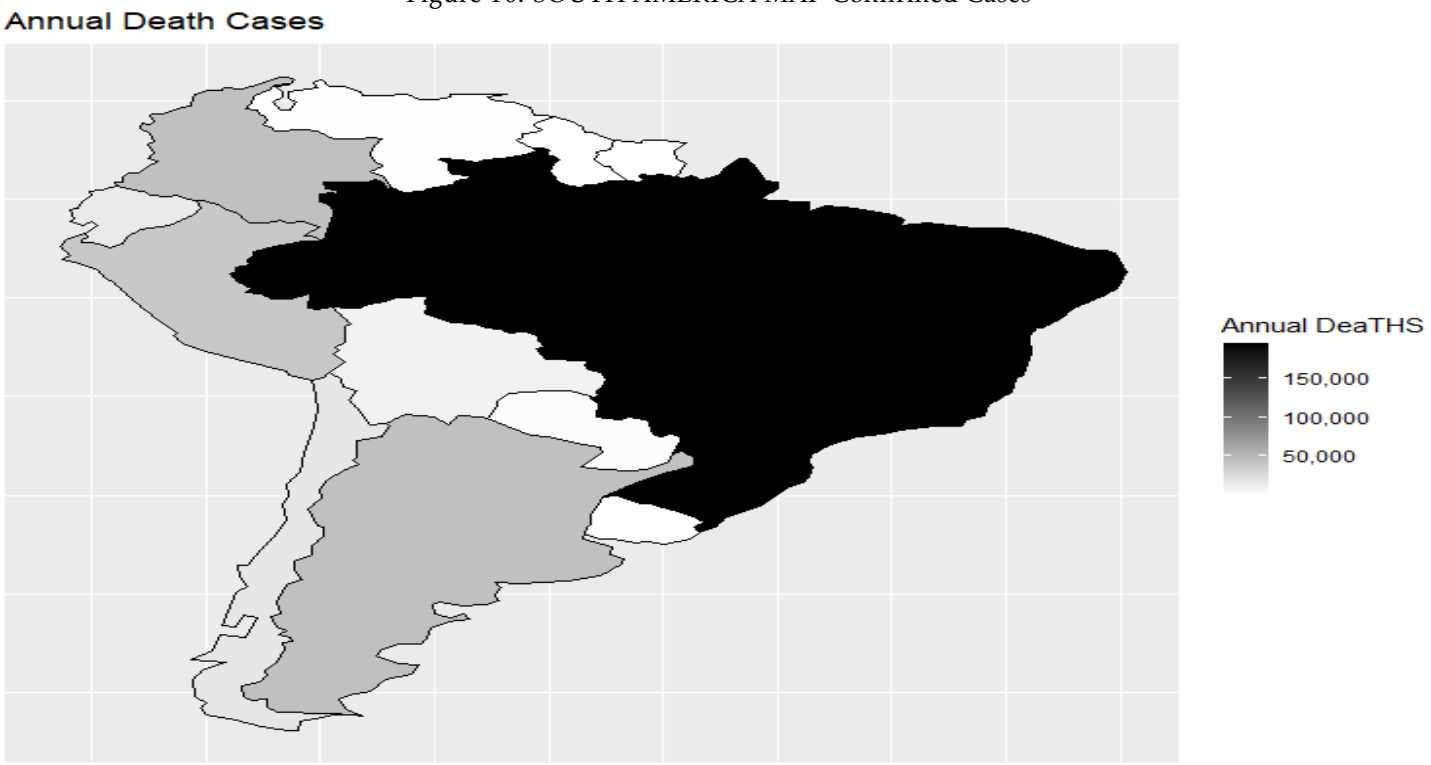


Figure 11: SOUTH AMERICA MAP Death Cases

**Greece Analysis**

```
#Greece Analysis
GreecePerMonth = data.frame(DatasetContDATES[Country== 'Greece', lapply(.SD,sum),
                                             by = .(Month), .SDcols =
```

```
                                                  c('DailyConfirmed', 'DailyDeaths')])
GreecePerMonth = GreecePerMonth %>% rename(MonthlyConfirmed = DailyConfirmed,
                                           MonthlyDeaths =DailyDeaths)
GreecePerMonth = melt(as.data.table(GreecePerMonth))
# PLOT GREECE Monthly
GR_Month01=ggplot(GreecePerMonth, aes(x = Month, y = value)) +
  geom_point(aes(color = variable)) +
  labs(title="Monthly Confirmed & Death Cases",
       subtitle="Greece 2020",
       caption = 'RedNumbers:Deaths/Month')+
  geom_text(data=(GreecePerMonth[variable=='MonthlyDeaths']),
            aes(label = value, angle =0, hjust='bottom', color='MonthlyDeaths' ))
GR_Monthly=GR_Month01 + geom_text(data=(GreecePerMonth[variable=='MonthlyConfirmed']),
                        aes(label = value, angle =0, hjust='bottom',
                            color='MonthlyConfirmed' ))

# PLOT GREECE Daily
GreecePerDay = data.frame(DatasetContDATES[Country== 'Greece', lapply(.SD,sum),
                                           by = .(Day, Month),
                                           .SDcols =
                                             c('DailyConfirmed', 'DailyDeaths')])
GreecePerDay = melt(as.data.table(GreecePerDay))

# Mean Confirmed & Deaths per Month
GreeceMeanCnD = data.frame(DatasetContDATES[Country== 'Greece', lapply(.SD,mean),
                                            by = .(Month),
                                            .SDcols =
                                              c('DailyConfirmed', 'DailyDeaths')])
GreeceMeanCnD = GreeceMeanCnD %>%
  rename(MeanConfirmed  = DailyConfirmed ,  MeanDeaths=DailyDeaths)
GreeceMeanCnD[,-1] <-round(GreeceMeanCnD[,-1],2) # Round the values


# PLOT GREECE per Day
plotGr=ggplot(GreecePerDay, aes(x = Day, y = value)) +
  geom_point(aes(color = variable)) +
  labs(title="Daily Confirmed & Death Cases", subtitle="Greece 2020",
       caption = 'Green: Mean Confirmed per Day
       Red:Mean Deaths per Day', x='All Days per Month',
       y= 'Number of Cases')+
    facet_grid(~ Month)+
    theme(axis.text.x = element_blank())
  plotGr2=plotGr + geom_text(x=5, y=2000, aes(label = MeanConfirmed ),
                             data = GreeceMeanCnD, angle=90,color='green')
  GR_Daily=plotGr2 +geom_text(x=20, y=2000, aes(label = MeanDeaths ),
                              data = GreeceMeanCnD, angle=90, color='red')
```

In this last part an analysis for Greece has been made. In figure 12 we can observe the Monthly Confirmed and Death cases for Greece. Finally in figure 13 we can observe the daily Confirmed and Death Cases for Greece. The green and the red numbers on the figure represent the mean Confirmed and mean Death Daily cases per month for the year 2020. What we can notice in both figures but especially in the 2nd one is that the Cases were extremely low at the initiation of the pandemic but they started to increase after August and they rocketed at the end of the year with the worst months being November and December.

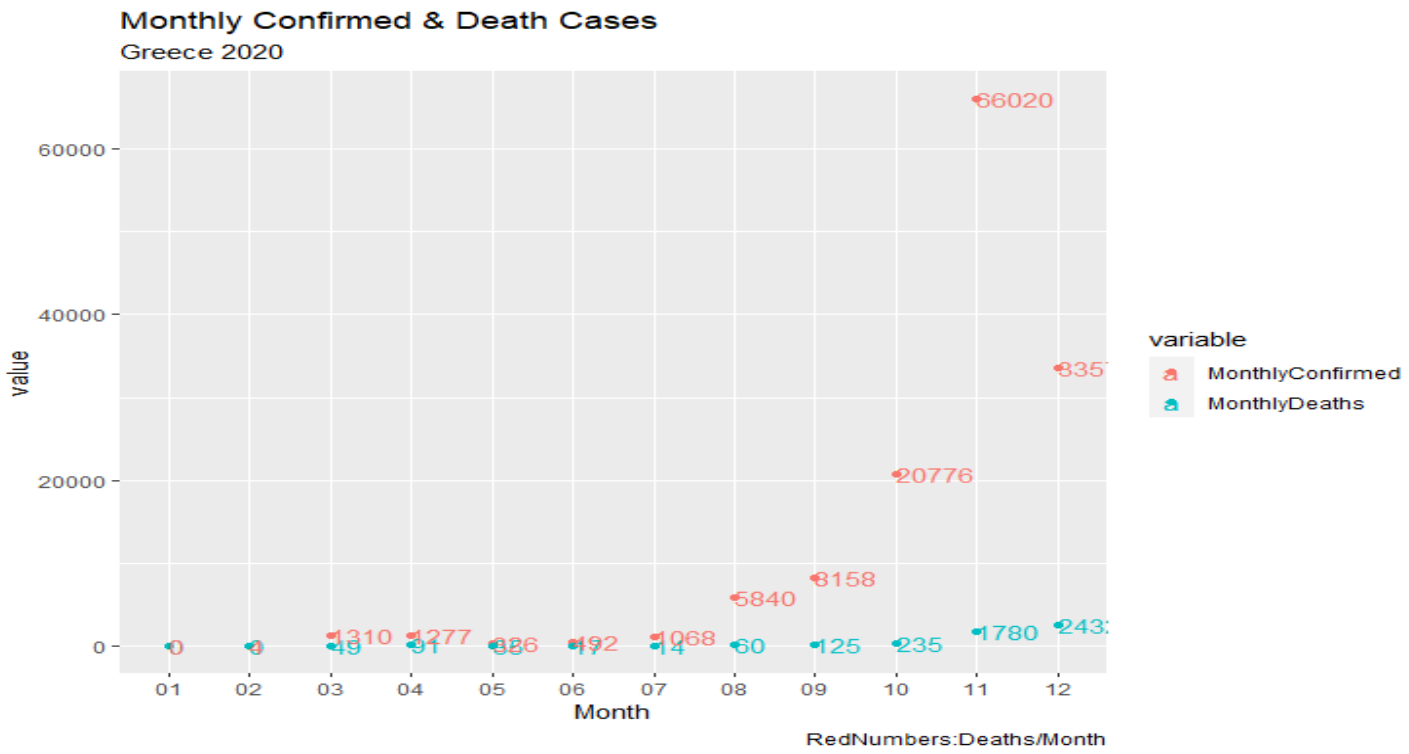


Figure 12: Greece Monthly Confirmed and Death Cases

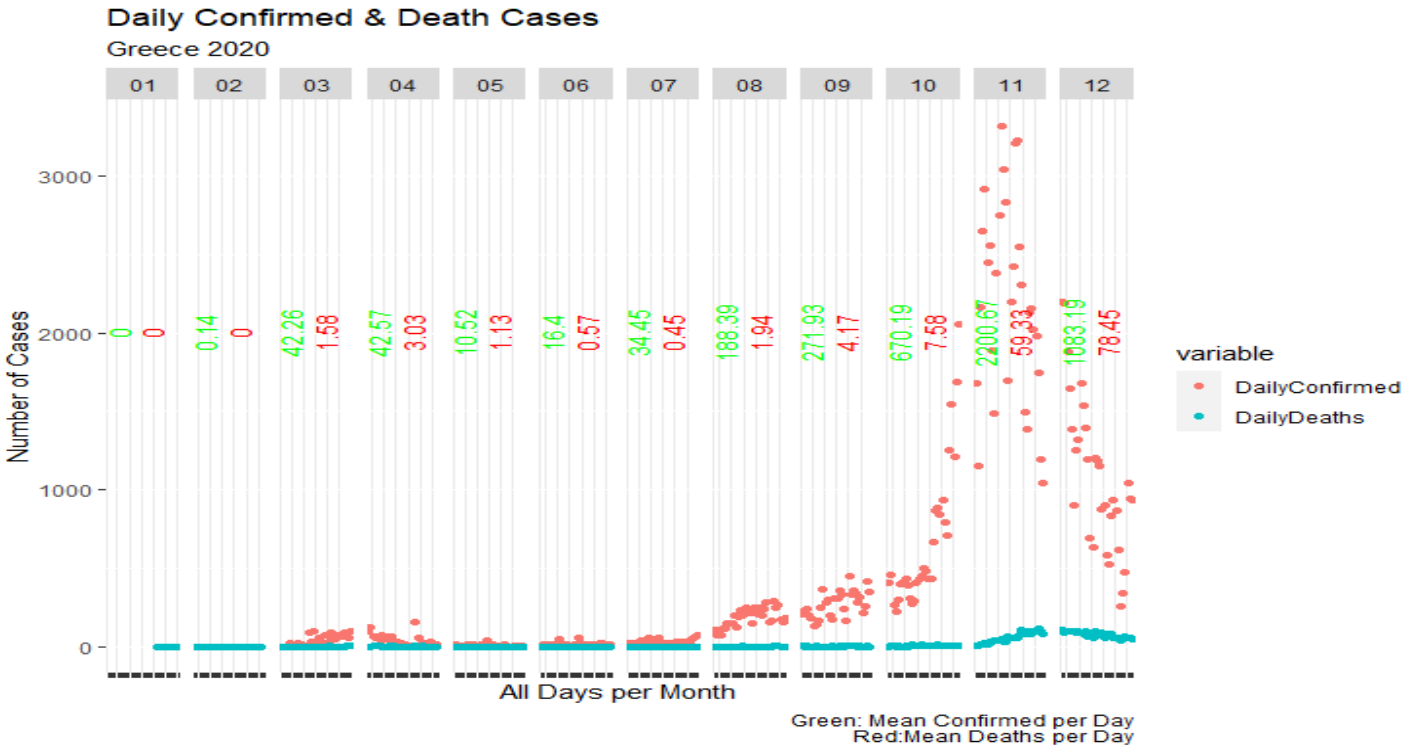


Figure 13: Greece Daily Confirmed and Death Cases