Data Science - COVID-19

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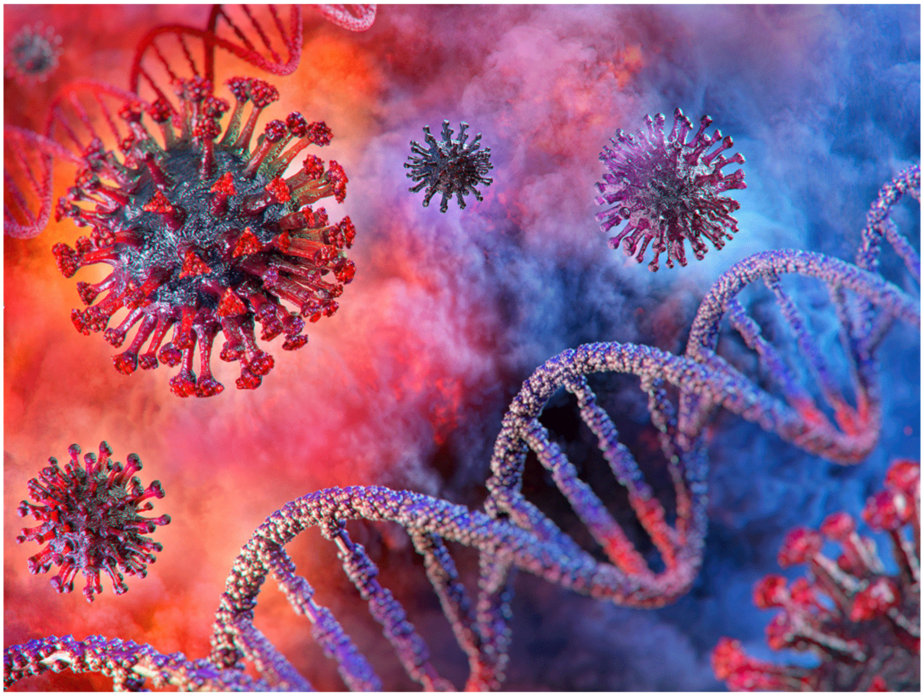


Analysis coronavirus disease (COVID-19).

This is an R Markdown document. It is intented to publicy illustrate how R statistics can help you out to output data science pipeline.

About this data

It changes rapidly

It doesn't include all cases

Confirmed cases aren't all cases. They only include people who tested positive. Testing rules and availability vary by country.

Data Repository: Johns Hopkins University.

```r
# This is an analysis report of the Novel Coronavirus (COVID-19)
# Aim for data processing, visualisation and statstics
# Source code: http://yanchang.rdatamining.com/
# set directory
# Data Source: 2019 Data Repository https://github.com/CSSEGISandData/COVID-19
# R Packages:
library(magrittr) # pipline operations
library(lubridate) # date operation
```

```
##
## Attaching package: 'lubridate'

## The following object is masked from 'package:base':
##
##     date
```

```r
library(tidyverse) # data science pips
```

```
## -- Attaching packages ------------------------------------------------------------------

## v ggplot2 3.3.0     v purrr   0.3.3
## v tibble  2.1.3     v dplyr   0.8.5
## v tidyr   1.0.2     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0

## -- Conflicts ---------------------------------------------------------------------------
## x lubridate::as.difftime() masks base::as.difftime()
## x lubridate::date()        masks base::date()
## x tidyr::extract()         masks magrittr::extract()
## x dplyr::filter()          masks stats::filter()
## x lubridate::intersect()   masks base::intersect()
## x dplyr::lag()             masks stats::lag()
## x purrr::set_names()       masks magrittr::set_names()
## x lubridate::setdiff()     masks base::setdiff()
## x lubridate::union()       masks base::union()
```

```r
library(gridExtra) # grid based plots
```

```
##
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':
##
##     combine
```

```r
library(dplyr)
library(leaflet)
library(ggforce)
library(kableExtra)
```

```
##
## Attaching package: 'kableExtra'

## The following object is masked from 'package:dplyr':
##
##     group_rows
```

```r
# Loading data
# At first, three CSV files, are downloaded and saved as local files
# and then loaded into R
# source data files changes everytime
filenames <- c('time_series_covid19_confirmed_global.csv',
               'time_series_covid19_deaths_global.csv',
               'time_series_covid19_recovered_global.csv')
url.path <- paste0('https://raw.githubusercontent.com/CSSEGISandData/COVID-19/',
                   'master/csse_covid_19_data/csse_covid_19_time_series/')

#download files to local folder
download <- function(filename) {
  url <- file.path(url.path, filename)
  dest <- file.path('./data', filename)
  download.file(url, dest)
}
bin <- lapply(filenames, download)


# load data into R
data.confirmed.original <- read.csv('./data/time_series_covid19_confirmed_global.csv')
data.deaths.original <- read.csv('./data/time_series_covid19_deaths_global.csv')
data.recovered.original <- read.csv('./data/time_series_covid19_recovered_global.csv')
```

```
# check dimension of data confirmed
dim(data.confirmed.original)
```

```
## [1] 258  76
```

Below we check the time frame of data set

```
# check time frame of the data
n.col <- ncol(data.confirmed.original) # 58 variables
# get dates from column names
dates <- names(data.confirmed.original)[5:n.col] %>% substr(2,8) %>% mdy()
range(dates)
```

```
## [1] "2020-01-22" "2020-04-02"
```

```
min.date <- min(dates)
max.date <- max(dates)
max.date.txt <- max.date %>% format('%d %b %Y')
min.date.txt <- min.date %>% format('%d %b Y')
# last update on 26 March 2020 max.date
```

```
# Data Preparation steps:
# 1.From wide to long format
# 2.Aggregate by country
# 3. merge into a signe dataset
# cleaning and transformation
cleanData <- function(data) {
  ## remove some columns
  data %<>% select(-c(Province.State, Lat, Long)) %>% rename(country=Country.Region)
  ## convert from wide to long format
  data %<>% gather(key=date, value=count, -country)
  ## convert from character to date
  data %<>% mutate(date = date %>% substr(2,8) %>% mdy())
  ## aggregate by country
  data %<>% group_by(country, date) %>% summarise(count=sum(count)) %>% as.data.frame()
  return(data)
}
# clean the three datasets
data.confirmed <- data.confirmed.original %>% cleanData() %>% rename(confirmed=count)
data.deaths <- data.deaths.original %>% cleanData() %>% rename(deaths=count)
data.recovered <- data.recovered.original %>% cleanData() %>% rename(recovered=count)

# merge above 3 datasets into one, by country and date
```

```r
data <- data.confirmed %>% merge(data.deaths, all = T) %>% merge(data.recovered, all = T)

# countries/regions with confirmed cases (excl cruise ships)
countries <- data %>% pull(country) %>% setdiff('Cruise Ship')

# last 10 records when it first broke out in Spain
data %>% filter(country =='Spain')%>% tail(10)
```

```
##    country       date confirmed deaths recovered
## 63   Spain 2020-03-24     39885   2808      3794
## 64   Spain 2020-03-25     49515   3647      5367
## 65   Spain 2020-03-26     57786   4365      7015
## 66   Spain 2020-03-27     65719   5138      9357
## 67   Spain 2020-03-28     73235   5982     12285
## 68   Spain 2020-03-29     80110   6803     14709
## 69   Spain 2020-03-30     87956   7716     16780
## 70   Spain 2020-03-31     95923   8464     19259
## 71   Spain 2020-04-01    104118   9387     22647
## 72   Spain 2020-04-02    112065  10348     26743
```

```r
# counts for worldwide
data.world <- data %>% group_by(date) %>%
  summarise(country='World',
            confirmed=sum(confirmed, na.rm = T),
            deaths=sum(deaths, na.rm = T),
            recovered=sum(recovered, na.rm = T))

data %<>% rbind(data.world)

# current confirmed cases
data %<>% mutate(remaining.confirmed = confirmed - deaths - recovered)
```

```r
# Visualisation
# After preparing the data, we portrait it in various graphs

# TOP Ten Countries
# ranking by confirmed cases
data.latest.all <- data %>% filter(date == max(date)) %>%
  select(country, date,
         confirmed, confirmed.new, remaining.confirmed, recovered, deaths.new, deaths, deat
# top 20 countries incl 11 World
k<- 20
top.countries <- data.latest.all %>% filter(ranking <= k+1) %>%
  arrange(ranking) %>% pull(country) %>% as.character()
top.countries %>% setdiff('World') %>% print()
```

```
##  [1] "US"             "Italy"          "Spain"          "Germany"
##  [5] "China"          "France"         "Iran"           "United Kingdom"
##  [9] "Switzerland"    "Turkey"         "Belgium"        "Netherlands"
## [13] "Canada"         "Austria"        "Korea, South"   "Portugal"
## [17] "Brazil"         "Israel"         "Sweden"         "Norway"
```

```
names(data.latest.all)
```

```
##  [1] "country"             "date"                "confirmed"
##  [4] "confirmed.new"       "remaining.confirmed" "recovered"
##  [7] "deaths.new"          "deaths"              "death.rate"
## [10] "ranking"
```

```
## add 'Others'
top.countries %<>% c('Others')
## put all others in a single group of 'Others'
data.latest <- data.latest.all %>% filter(!is.na(country)) %>%
mutate(country=ifelse(ranking <= k + 1, as.character(country), 'Others')) %>%
mutate(country=country %>% factor(levels=c(top.countries)))

data.latest %<>% group_by(country) %>%
  summarise(confirmed=sum(confirmed), confirmed.new=sum(confirmed.new), remaining.confirmed
            mutate(death.rate=(100*deaths/confirmed) %>% round(1))
data.latest %<>% select(c(country, confirmed, deaths,death.rate, confirmed.new, deaths.new,

data.latest %>% mutate(death.rate=death.rate %>% format(nsmall=1) %>% paste0('%')) %>% kable
```

Worldmap

```
x <- data.confirmed.original
x$confirmed <- x[, ncol(x)]
x %>% select(c(Country.Region, Province.State, Lat, Long, confirmed)) %>%
  mutate(txt=paste0(Country.Region, '-', Province.State, ':', confirmed))
```

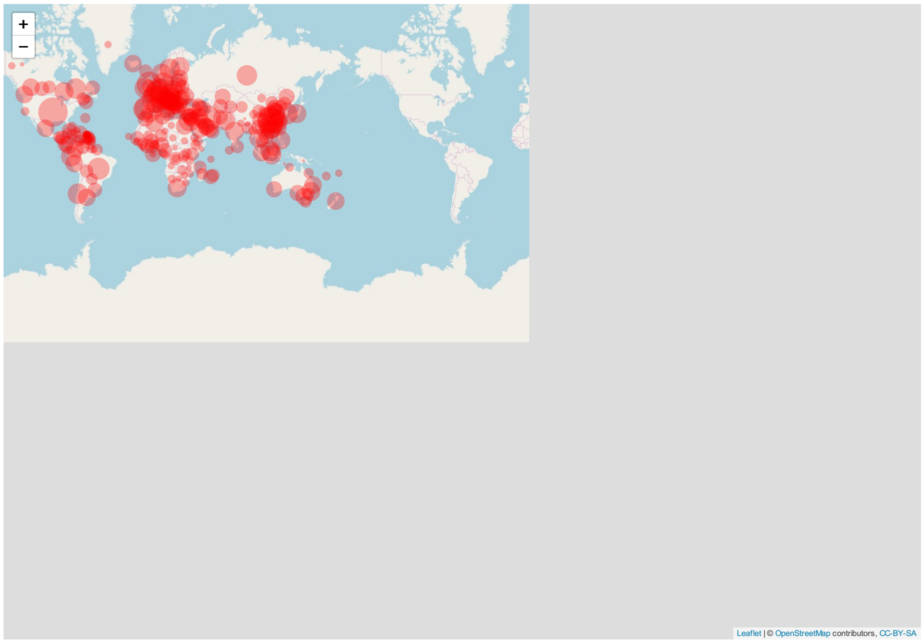
```
##                        Country.Region                    Province.State
## 1                         Afghanistan
## 2                             Albania
## 3                             Algeria
## 4                             Andorra
## 5                              Angola
## 6                 Antigua and Barbuda
## 7                           Argentina
## 8                             Armenia
## 9                           Australia     Australian Capital Territory
```

Table 1: Cases in Top 20 Countries - 02 Apr 2020.

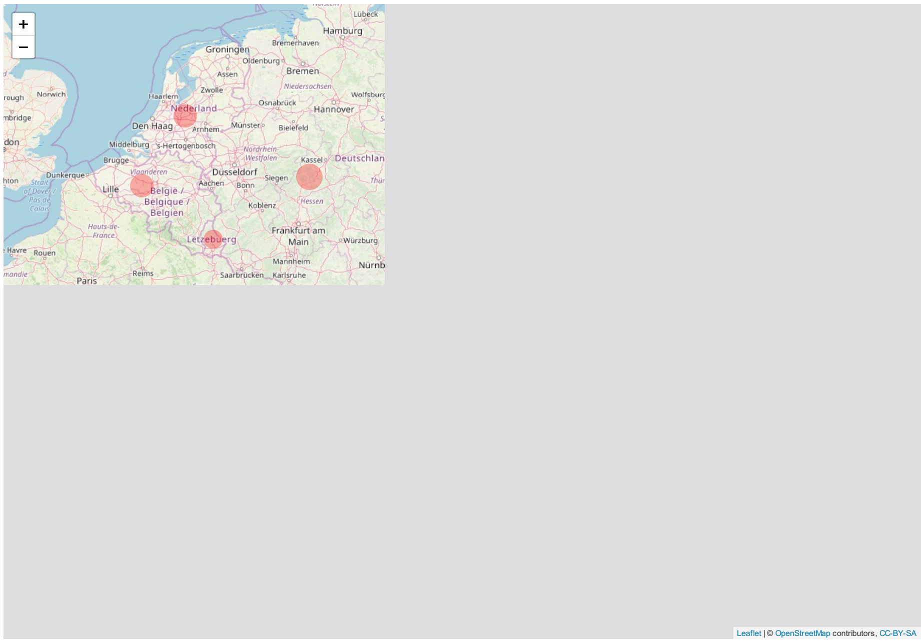
	country	confirmed	deaths	death.rate	confirmed.new	deaths.new	remaining.confirmed
1	World	1,013,157	52,983	5.2%	80,552	6,174	749,911
2	US	243,453	5,926	2.4%	30,081	1,169	228,526
3	Italy	115,242	13,915	12.1%	4,668	760	83,049
4	Spain	112,065	10,348	9.2%	7,947	961	74,974
5	Germany	84,794	1,107	1.3%	6,922	187	61,247
6	China	82,432	3,322	4.0%	71	6	2,545
7	France	59,929	5,398	9.0%	2,180	1,355	41,983
8	Iran	50,468	3,160	6.3%	2,875	124	30,597
9	United Kingdom	34,173	2,926	8.6%	4,308	569	31,055
10	Switzerland	18,827	536	2.8%	1,059	48	14,278
11	Turkey	18,135	356	2.0%	2,456	79	17,364
12	Belgium	15,348	1,011	6.6%	1,384	183	11,842
13	Netherlands	14,788	1,341	9.1%	1,092	166	13,187
14	Canada	11,284	139	1.2%	1,724	30	9,410
15	Austria	11,129	158	1.4%	418	12	9,222
16	Korea, South	9,976	169	1.7%	89	4	3,979
17	Portugal	9,034	209	2.3%	783	22	8,757
18	Brazil	8,044	324	4.0%	1,208	84	7,593
19	Israel	6,857	36	0.5%	765	10	6,483
20	Sweden	5,568	308	5.5%	621	69	5,157
21	Norway	5,147	50	1.0%	284	6	5,065
22	Others	96,464	2,244	2.3%	9,617	330	83,598

```
## 10                          Australia                   New South Wales
## 11                          Australia                Northern Territory
## 12                          Australia                        Queensland
## 13                          Australia                   South Australia
## 14                          Australia                          Tasmania
## 15                          Australia                          Victoria
## 16                          Australia                 Western Australia
## 17                            Austria
## 18                         Azerbaijan
## 19                            Bahamas
## 20                            Bahrain
## 21                         Bangladesh
## 22                           Barbados
## 23                            Belarus
## 24                            Belgium
## 25                              Benin
## 26                             Bhutan
## 27                            Bolivia
## 28             Bosnia and Herzegovina
## 29                             Brazil
## 30                             Brunei
## 31                           Bulgaria
## 32                      Burkina Faso
## 33                        Cabo Verde
## 34                          Cambodia
## 35                          Cameroon
## 36                            Canada                          Alberta
## 37                            Canada                 British Columbia
## 38                            Canada                   Grand Princess
## 39                            Canada                         Manitoba
## 40                            Canada                    New Brunswick
## 41                            Canada        Newfoundland and Labrador
## 42                            Canada                      Nova Scotia
## 43                            Canada                          Ontario
## 44                            Canada             Prince Edward Island
## 45                            Canada                           Quebec
## 46                            Canada                     Saskatchewan
## 47          Central African Republic
## 48                              Chad
## 49                             Chile
## 50                             China                            Anhui
## 51                             China                          Beijing
## 52                             China                        Chongqing
## 53                             China                           Fujian
## 54                             China                            Gansu
## 55                             China                        Guangdong
## 56                             China                          Guangxi
## 57                             China                          Guizhou
## 58                             China                           Hainan
## 59                             China                            Hebei
## 60                             China                     Heilongjiang
## 61                             China                            Henan
## 62                             China                        Hong Kong
## 63                             China                            Hubei
## 64                             China                            Hunan
## 65                             China                   Inner Mongolia
## 66                             China                          Jiangsu
## 67                             China                          Jiangxi
## 68                             China                            Jilin
## 69                             China                         Liaoning
## 70                             China                            Macau
## 71                             China                          Ningxia
## 72                             China                          Qinghai
## 73                             China                          Shaanxi
## 74                             China                         Shandong
## 75                             China                         Shanghai
## 76                             China                           Shanxi
## 77                             China                          Sichuan
## 78                              China                          Tianjin
## 79                              China                            Tibet
## 80                              China                         Xinjiang
## 81                              China                           Yunnan
## 82                              China                         Zhejiang
## 83                           Colombia
## 84                Congo (Brazzaville)
## 85                   Congo (Kinshasa)
## 86                         Costa Rica
## 87                      Cote d'Ivoire
## 88                            Croatia
## 89                   Diamond Princess
## 90                               Cuba
## 91                             Cyprus
## 92                            Czechia
## 93                            Denmark                    Faroe Islands
## 94                            Denmark                        Greenland
## 95                            Denmark
## 96                           Djibouti
## 97                 Dominican Republic
## 98                            Ecuador
## 99                              Egypt
## 100                       El Salvador
## 101                 Equatorial Guinea
## 102                           Eritrea
## 103                           Estonia
## 104                          Eswatini
## 105                          Ethiopia
## 106                              Fiji
## 107                           Finland
## 108                            France                    French Guiana
## 109                            France                 French Polynesia
## 110                            France                       Guadeloupe
## 111                            France                          Mayotte
## 112                            France                    New Caledonia
## 113                            France                          Reunion
## 114                            France                 Saint Barthelemy
## 115                            France                        St Martin
## 116                            France                       Martinique
## 117                            France
## 118                             Gabon
## 119                            Gambia
## 120                           Georgia
## 121                           Germany
## 122                             Ghana
## 123                            Greece
## 124                        Guatemala
## 125                           Guinea
## 126                           Guyana
## 127                            Haiti
## 128                         Holy See
## 129                         Honduras
## 130                          Hungary
## 131                          Iceland
## 132                            India
## 133                        Indonesia
## 134                             Iran
## 135                             Iraq
## 136                          Ireland
## 137                           Israel
## 138                            Italy
## 139                          Jamaica
## 140                            Japan
## 141                           Jordan
## 142                       Kazakhstan
## 143                            Kenya
## 144                     Korea, South
## 145                           Kuwait
## 146                       Kyrgyzstan
## 147                           Latvia
## 148                          Lebanon
## 149                          Liberia
## 150                    Liechtenstein
## 151                        Lithuania
## 152                       Luxembourg
## 153                       Madagascar
## 154                         Malaysia
## 155                         Maldives
## 156                            Malta
## 157                       Mauritania
## 158                        Mauritius
## 159                           Mexico
## 160                          Moldova
## 161                           Monaco
## 162                         Mongolia
## 163                       Montenegro
## 164                          Morocco
## 165                          Namibia
## 166                            Nepal
## 167                      Netherlands                            Aruba
## 168                      Netherlands                          Curacao
## 169                      Netherlands                     Sint Maarten
## 170                      Netherlands
## 171                      New Zealand
## 172                        Nicaragua
## 173                            Niger
## 174                          Nigeria
## 175                  North Macedonia
## 176                           Norway
## 177                             Oman
## 178                         Pakistan
## 179                           Panama
## 180                 Papua New Guinea
## 181                         Paraguay
## 182                             Peru
## 183                      Philippines
## 184                           Poland
## 185                         Portugal
## 186                            Qatar
## 187                          Romania
## 188                           Russia
## 189                           Rwanda
## 190                      Saint Lucia
## 191 Saint Vincent and the Grenadines
## 192                       San Marino
## 193                     Saudi Arabia
## 194                          Senegal
## 195                           Serbia
## 196                       Seychelles
## 197                        Singapore
## 198                         Slovakia
## 199                         Slovenia
## 200                          Somalia
## 201                     South Africa
## 202                            Spain
## 203                        Sri Lanka
## 204                            Sudan
## 205                         Suriname
## 206                           Sweden
## 207                      Switzerland
## 208                          Taiwan*
## 209                         Tanzania
## 210                         Thailand
## 211                             Togo
## 212              Trinidad and Tobago
## 213                          Tunisia
## 214                           Turkey
## 215                           Uganda
## 216                          Ukraine
## 217             United Arab Emirates
## 218                   United Kingdom                          Bermuda
## 219                   United Kingdom                   Cayman Islands
## 220                   United Kingdom                  Channel Islands
## 221                   United Kingdom                        Gibraltar
## 222                   United Kingdom                      Isle of Man
## 223                   United Kingdom                       Montserrat
## 224                   United Kingdom
## 225                          Uruguay
## 226                               US
## 227                       Uzbekistan
## 228                        Venezuela
## 229                          Vietnam
## 230                           Zambia
## 231                         Zimbabwe
## 232                           Canada                 Diamond Princess
## 233                         Dominica
## 234                          Grenada
## 235                       Mozambique
## 236                            Syria
## 237                      Timor-Leste
## 238                           Belize
## 239                           Canada                        Recovered
## 240                             Laos
## 241                            Libya
## 242                West Bank and Gaza
## 243                    Guinea-Bissau
## 244                             Mali
## 245             Saint Kitts and Nevis
## 246                           Canada            Northwest Territories
## 247                           Canada                            Yukon
## 248                           Kosovo
## 249                            Burma
## 250                   United Kingdom                         Anguilla
## 251                   United Kingdom           British Virgin Islands
## 252                   United Kingdom         Turks and Caicos Islands
## 253                       MS Zaandam
## 254                         Botswana
## 255                          Burundi
## 256                     Sierra Leone
## 257                      Netherlands Bonaire, Sint Eustatius and Saba
## 258                           Malawi
##            Lat        Long confirmed
## 1    33.000000   65.000000       273
## 2    41.153300   20.168300       277
## 3     28.033900    1.659600       986
## 4     42.506300    1.521800       428
## 5    -11.202700   17.873900         8
## 6     17.060800  -61.796400         9
## 7    -38.416100  -63.616700      1133
## 8     40.069100   45.038200       663
## 9    -35.473500  149.012400        87
## 10   -33.868800  151.209300      2298
## 11   -12.463400  130.845600        21
## 12   -28.016700  153.400000       835
## 13   -34.928500  138.600700       367
## 14   -41.454500  145.970700        72
## 15   -37.813600  144.963100      1036
## 16   -31.950500  115.860500       400
## 17    47.516200   14.550100     11129
## 18    40.143100   47.576900       400
## 19    25.034300  -77.396300        24
## 20    26.027500   50.550000       643
## 21    23.685000   90.356300        56
## 22    13.193900  -59.543200        46
## 23    53.709800   27.953400       304
## 24    50.833300    4.000000     15348
## 25     9.307700    2.315800        13
## 26    27.514200   90.433600         5
## 27   -16.290200  -63.588700       123
## 28    43.915900   17.679100       533
## 29   -14.235000  -51.925300      8044
## 30     4.535300  114.727700       133
## 31    42.733900   25.485800       457
## 32    12.238300   -1.561600       288
## 33    16.538800  -23.041800         6
## 34    11.550000  104.916700       110
## 35     3.848000   11.502100       306
## 36    53.933300 -116.576500       969
## 37    49.282700 -123.120700      1121
## 38    37.648900 -122.665500        13
## 39    53.760900  -98.813900       167
## 40    46.565300  -66.461900        91
## 41    53.135500  -57.660400       183
## 42    44.682000  -63.744300       193
## 43    51.253800  -85.323200      2793
## 44    46.510700  -63.416800        22
## 45    52.939900  -73.549100      5518
## 46    52.939900 -106.450900       206
## 47     6.611100   20.939400         3
## 48    15.454200   18.732200         8
## 49  -35.675100  -71.543000      3404
## 50   31.825700  117.226400       990
## 51   40.182400  116.414200       582
## 52   30.057200  107.874000       579
## 53   26.078900  117.987400       345
## 54   37.809900  101.058300       138
## 55   23.341700  113.424400      1507
## 56   23.829800  108.788100       254
## 57   26.815400  106.874800       146
## 58   19.195900  109.745300       168
## 59   39.549000  116.130600       325
## 60   47.862000  127.761500       488
## 61   33.882000  113.614000      1276
## 62   22.300000  114.200000       802
## 63   30.975600  112.270700     67802
## 64   27.610400  111.708800      1019
## 65   44.093500  113.944800       117
## 66   32.971100  119.455000       647
## 67   27.614000  115.722100       937
## 68   43.666100  126.192300        98
## 69   41.295600  122.608500       141
## 70   22.166700  113.550000        41
## 71   37.269200  106.165500        75
## 72   35.745200   95.995600        18
## 73   35.191700  108.870100       255
## 74   36.342700  118.149800       775
## 75   31.202000  121.449100       522
## 76   37.577700  112.292200       137
## 77   30.617100  102.710300       554
## 78   39.305400  117.323000       176
## 79   31.692700   88.092400         1
## 80   41.112900   85.240100        76
## 81   24.974000  101.487000       183
## 82   29.183200  120.093400      1258
## 83    4.570900  -74.297300      1161
## 84   -4.038300   21.758700        22
## 85   -4.038300   21.758700       134
## 86    9.748900  -83.753400       396
## 87    7.540000   -5.547100       194
## 88   45.100000   15.200000      1011
## 89    0.000000    0.000000       712
## 90   22.000000  -80.000000       233
## 91   35.126400   33.429900       356
## 92   49.817500   15.473000      3858
## 93   61.892600   -6.911800       177
## 94   71.706900  -42.604300        10
## 95   56.263900    9.501800      3386
## 96   11.825100   42.590300        40
## 97   18.735700  -70.162700      1380
## 98   -1.831200  -78.183400      3163
## 99   26.000000   30.000000       865
## 100  13.794200  -88.896500        41
## 101   1.500000   10.000000        15
## 102  15.179400   39.782300        22
## 103  58.595300   25.013600       858
## 104 -26.522500   31.465900         9
## 105   9.145000   40.489700        29
## 106 -17.713400  178.065000         7
## 107  64.000000   26.000000      1518
## 108   3.933900  -53.125800        51
## 109 -17.679700  149.406800        37
## 110  16.250000  -61.583300       128
## 111 -12.827500   45.166200       116
## 112 -20.904300  165.618000        18
## 113 -21.135100   55.247100       308
## 114  17.900000  -62.833300         6
## 115  18.070800  -63.050100        22
## 116  14.641500  -61.024200       138
## 117  46.227600    2.213700     59105
## 118  -0.803700   11.609400        21
## 119  13.443200  -15.310100         4
## 120  42.315400   43.356900       134
## 121  51.000000    9.000000     84794
## 122   7.946500   -1.023200       204
## 123  39.074200   21.824300      1544
## 124  15.783500  -90.230800        47
## 125   9.945600   -9.696600        52
## 126   5.000000  -58.750000        19
## 127  18.971200  -72.285200        16
## 128  41.902900   12.453400         7
## 129  15.200000  -86.241900       219
## 130  47.162500   19.503300       585
## 131  64.963100  -19.020800      1319
## 132  21.000000   78.000000      2543
## 133  -0.789300  113.921300      1790
## 134  32.000000   53.000000     50468
## 135  33.000000   44.000000       772
## 136  53.142400   -7.692100      3849
## 137  31.000000   35.000000      6857
## 138  43.000000   12.000000    115242
## 139  18.109600  -77.297500        47
## 140  36.000000  138.000000      2495
## 141  31.240000   36.510000        299
## 142  48.019600   66.923700        435
## 143  -0.023600   37.906200        110
## 144  36.000000  128.000000       9976
## 145  29.500000   47.750000        342
## 146  41.204400   74.766100        116
## 147  56.879600   24.603200        458
## 148  33.854700   35.862300        494
## 149   6.428100   -9.429500          6
## 150  47.140000    9.550000         75
## 151  55.169400   23.881300        649
## 152  49.815300    6.129600       2487
## 153 -18.766900   46.869100         59
## 154   2.500000  112.500000       3116
## 155   3.202800   73.220700         19
## 156  35.937500   14.375400        196
## 157  21.007900   10.940800          6
## 158 -20.200000   57.500000        169
## 159  23.634500 -102.552800       1378
## 160  47.411600   28.369900        505
## 161  43.733300    7.416700         60
## 162  46.862500  103.846700         14
## 163  42.500000   19.300000        144
## 164  31.791700   -7.092600        708
## 165 -22.957600   18.490400         14
## 166  28.166700   84.250000          6
## 167  12.518600  -70.035800         60
## 168  12.169600  -68.990000         11
## 169  18.042500  -63.054800         18
## 170  52.132600    5.291300      14697
## 171 -40.900600  174.886000        797
## 172  12.865400  -85.207200          5
## 173  17.607800    8.081700         98
## 174   9.082000    8.675300        184
## 175  41.608600   21.745300        384
## 176  60.472000    8.468900       5147
## 177  21.000000   57.000000        231
## 178  30.375300   69.345100       2421
## 179   8.538000  -80.782100       1317
## 180  -6.315000  143.955500          1
## 181 -23.442500  -58.443800         77
## 182  -9.190000  -75.015200       1414
## 183  13.000000  122.000000       2633
## 184  51.919400   19.145100       2946
## 185  39.399900   -8.224500       9034
## 186  25.354800   51.183900        949
## 187  45.943200  24.966800      2738
## 188  60.000000  90.000000      3548
## 189  -1.940300  29.873900        84
## 190  13.909400 -60.978900        13
## 191  12.984300 -61.287200         2
## 192  43.942400  12.457800       245
## 193  24.000000  45.000000      1885
## 194  14.497400 -14.452400       195
## 195  44.016500  21.005900      1171
## 196  -4.679600  55.492000        10
## 197   1.283300 103.833300      1049
## 198  48.669000  19.699000       426
## 199  46.151200  14.995500       897
## 200   5.152100  46.199600         5
## 201 -30.559500  22.937500      1462
## 202  40.000000  -4.000000    112065
## 203   7.000000  81.000000       151
## 204  12.862800  30.217600         8
## 205   3.919300 -56.027800        10
## 206  63.000000  16.000000      5568
## 207  46.818200   8.227500     18827
## 208  23.700000 121.000000       339
## 209  -6.369000  34.888800        20
## 210  15.000000 101.000000      1875
## 211   8.619500   0.824800        39
## 212  10.691800 -61.222500        94
## 213  34.000000   9.000000       455
## 214  38.963700  35.243300     18135
## 215   1.000000  32.000000        45
## 216  48.379400  31.165600       897
## 217  24.000000  54.000000      1024
## 218  32.307800 -64.750500        35
## 219  19.313300 -81.254600        28
## 220  49.372300  -2.364400       193
## 221  36.140800  -5.353600        88
## 222  54.236100  -4.548100        95
## 223  16.742500 -62.187400         5
## 224  55.378100  -3.436000     33718
## 225 -32.522800 -55.765800       350
## 226  37.090200 -95.712900    243453
## 227  41.377500  64.585300       205
## 228   6.423800 -66.589700       146
## 229  16.000000 108.000000       233
## 230 -15.416700  28.283300        39
## 231 -20.000000  30.000000         9
## 232   0.000000   0.000000         0
## 233  15.415000  -61.371000        12
## 234  12.116500  -61.679000        10
## 235 -18.665695   35.529562        10
## 236  34.802075   38.996815        16
## 237  -8.874217  125.727539         1
## 238  13.193900  -59.543200         3
## 239   0.000000    0.000000         0
## 240  19.856270  102.495496        10
## 241  26.335100   17.228331        11
## 242  31.952200   35.233200       161
## 243  11.803700  -15.180400         9
## 244  17.570692   -3.996166        36
## 245  17.357822  -62.782998         9
## 246  64.825500 -124.845700         2
## 247  64.282300 -135.000000         6
## 248  42.602636   20.902977       125
## 249  21.916200   95.956000        20
## 250  18.220600  -63.068600         3
## 251  18.420700  -64.640000         3
## 252  21.694000  -71.797900         5
## 253   0.000000    0.000000         9
## 254 -22.328500   24.684900         4
## 255  -3.373100   29.918900         3
## 256   8.460555  -11.779889         2
## 257  12.178400  -68.238500         2
## 258 -13.254308   34.301525         3
##                                                 txt
## 1                               Afghanistan-:273
## 2                                   Albania-:277
## 3                                   Algeria-:986
## 4                                   Andorra-:428
## 5                                      Angola-:8
## 6                         Antigua and Barbuda-:9
## 7                                Argentina-:1133
## 8                                   Armenia-:663
## 9        Australia-Australian Capital Territory:87
## 10                Australia-New South Wales:2298
## 11               Australia-Northern Territory:21
## 12                      Australia-Queensland:835
## 13                 Australia-South Australia:367
## 14                         Australia-Tasmania:72
## 15                       Australia-Victoria:1036
## 16               Australia-Western Australia:400
## 17                                Austria-:11129
## 18                               Azerbaijan-:400
## 19                                   Bahamas-:24
## 20                                    Bahrain-:643
## 21                                  Bangladesh-:56
## 22                                    Barbados-:46
## 23                                    Belarus-:304
## 24                                  Belgium-:15348
## 25                                       Benin-:13
## 26                                       Bhutan-:5
## 27                                    Bolivia-:123
## 28                     Bosnia and Herzegovina-:533
## 29                                    Brazil-:8044
## 30                                     Brunei-:133
## 31                                   Bulgaria-:457
## 32                               Burkina Faso-:288
## 33                                   Cabo Verde-:6
## 34                                   Cambodia-:110
## 35                                   Cameroon-:306
## 36                              Canada-Alberta:969
## 37                    Canada-British Columbia:1121
## 38                        Canada-Grand Princess:13
## 39                             Canada-Manitoba:167
## 40                         Canada-New Brunswick:91
## 41            Canada-Newfoundland and Labrador:183
## 42                          Canada-Nova Scotia:193
## 43                             Canada-Ontario:2793
## 44                  Canada-Prince Edward Island:22
## 45                              Canada-Quebec:5518
## 46                         Canada-Saskatchewan:206
## 47                     Central African Republic-:3
## 48                                         Chad-:8
## 49                                     Chile-:3404
## 50                                 China-Anhui:990
## 51                               China-Beijing:582
## 52                             China-Chongqing:579
## 53                                China-Fujian:345
## 54                                 China-Gansu:138
## 55                            China-Guangdong:1507
## 56                               China-Guangxi:254
## 57                               China-Guizhou:146
## 58                                China-Hainan:168
## 59                                 China-Hebei:325
## 60                          China-Heilongjiang:488
## 61                                China-Henan:1276
## 62                             China-Hong Kong:802
## 63                               China-Hubei:67802
## 64                                China-Hunan:1019
## 65                        China-Inner Mongolia:117
## 66                               China-Jiangsu:647
## 67                               China-Jiangxi:937
## 68                                  China-Jilin:98
## 69                              China-Liaoning:141
## 70                                  China-Macau:41
## 71                                China-Ningxia:75
## 72                                China-Qinghai:18
## 73                               China-Shaanxi:255
## 74                              China-Shandong:775
## 75                              China-Shanghai:522
## 76                                China-Shanxi:137
## 77                               China-Sichuan:554
## 78                               China-Tianjin:176
## 79                                   China-Tibet:1
## 80                               China-Xinjiang:76
## 81                                China-Yunnan:183
## 82                             China-Zhejiang:1258
## 83                                  Colombia-:1161
## 84                         Congo (Brazzaville)-:22
## 85                           Congo (Kinshasa)-:134
## 86                                 Costa Rica-:396
## 87                              Cote d'Ivoire-:194
## 88                                   Croatia-:1011
## 89                           Diamond Princess-:712
## 90                                       Cuba-:233
## 91                                     Cyprus-:356
## 92                                   Czechia-:3858
## 93                       Denmark-Faroe Islands:177
## 94                            Denmark-Greenland:10
## 95                                   Denmark-:3386
## 96                                    Djibouti-:40
## 97                        Dominican Republic-:1380
## 98                                   Ecuador-:3163
## 99                                      Egypt-:865
## 100                               El Salvador-:41
## 101                         Equatorial Guinea-:15
## 102                                   Eritrea-:22
## 103                                  Estonia-:858
## 104                                   Eswatini-:9
## 105                                  Ethiopia-:29
## 106                                       Fiji-:7
## 107                                 Finland-:1518
## 108                       France-French Guiana:51
## 109                    France-French Polynesia:37
## 110                         France-Guadeloupe:128
## 111                            France-Mayotte:116
## 112                        France-New Caledonia:18
## 113                             France-Reunion:308
## 114                      France-Saint Barthelemy:6
## 115                            France-St Martin:22
## 116                          France-Martinique:138
## 117                                  France-:59105
## 118                                      Gabon-:21
## 119                                      Gambia-:4
## 120                                   Georgia-:134
## 121                                 Germany-:84794
## 122                                     Ghana-:204
## 123                                   Greece-:1544
## 124                                  Guatemala-:47
## 125                                     Guinea-:52
## 126                                     Guyana-:19
## 127                                      Haiti-:16
## 128                                    Holy See-:7
## 129                                  Honduras-:219
## 130                                   Hungary-:585
## 131                                  Iceland-:1319
## 132                                    India-:2543
## 133                                Indonesia-:1790
## 134                                    Iran-:50468
## 135                                      Iraq-:772
## 136                                  Ireland-:3849
## 137                                   Israel-:6857
## 138                                  Italy-:115242
## 139                                    Jamaica-:47
## 140                                    Japan-:2495
## 141                                    Jordan-:299
## 142                                Kazakhstan-:435
## 143                                     Kenya-:110
## 144                             Korea, South-:9976
## 145                                    Kuwait-:342
## 146                                Kyrgyzstan-:116
## 147                                    Latvia-:458
## 148                                   Lebanon-:494
## 149                                     Liberia-:6
## 150                              Liechtenstein-:75
## 151                                 Lithuania-:649
## 152                               Luxembourg-:2487
## 153                                 Madagascar-:59
## 154                                 Malaysia-:3116
## 155                                   Maldives-:19
## 156                                     Malta-:196
## 157                                  Mauritania-:6
## 158                                 Mauritius-:169
## 159                                   Mexico-:1378
## 160                                   Moldova-:505
## 161                                     Monaco-:60
## 162                                   Mongolia-:14
## 163                                Montenegro-:144
## 164                                   Morocco-:708
## 165                                    Namibia-:14
## 166                                       Nepal-:6
## 167                           Netherlands-Aruba:60
## 168                         Netherlands-Curacao:11
## 169                    Netherlands-Sint Maarten:18
## 170                             Netherlands-:14697
## 171                               New Zealand-:797
## 172                                   Nicaragua-:5
## 173                                      Niger-:98
## 174                                   Nigeria-:184
## 175                           North Macedonia-:384
## 176                                   Norway-:5147
## 177                                      Oman-:231
## 178                                 Pakistan-:2421
## 179                                   Panama-:1317
## 180                            Papua New Guinea-:1
## 181                                   Paraguay-:77
## 182                                     Peru-:1414
## 183                              Philippines-:2633
## 184                                   Poland-:2946
## 185                                 Portugal-:9034
## 186                                     Qatar-:949
## 187                                  Romania-:2738
## 188                                   Russia-:3548
## 189                                     Rwanda-:84
## 190                                Saint Lucia-:13
## 191            Saint Vincent and the Grenadines-:2
## 192                                San Marino-:245
## 193                             Saudi Arabia-:1885
## 194                                   Senegal-:195
## 195                                   Serbia-:1171
## 196                                 Seychelles-:10
## 197                                Singapore-:1049
## 198                                  Slovakia-:426
## 199                                  Slovenia-:897
## 200                                     Somalia-:5
## 201                             South Africa-:1462
## 202                                  Spain-:112065
## 203                                 Sri Lanka-:151
## 204                                       Sudan-:8
## 205                                    Suriname-:10
## 206                                   Sweden-:5568
## 207                             Switzerland-:18827
## 208                                   Taiwan*-:339
## 209                                    Tanzania-:20
## 210                                 Thailand-:1875
## 211                                       Togo-:39
## 212                        Trinidad and Tobago-:94
## 213                                   Tunisia-:455
## 214                                  Turkey-:18135
## 215                                     Uganda-:45
## 216                                   Ukraine-:897
## 217                     United Arab Emirates-:1024
## 218                      United Kingdom-Bermuda:35
## 219               United Kingdom-Cayman Islands:28
## 220             United Kingdom-Channel Islands:193
## 221                    United Kingdom-Gibraltar:88
## 222                  United Kingdom-Isle of Man:95
## 223                    United Kingdom-Montserrat:5
## 224                          United Kingdom-:33718
## 225                                   Uruguay-:350
## 226                                     US-:243453
## 227                                Uzbekistan-:205
## 228                                 Venezuela-:146
## 229                                   Vietnam-:233
## 230                                     Zambia-:39
## 231                                    Zimbabwe-:9
## 232                      Canada-Diamond Princess:0
## 233                                   Dominica-:12
## 234                                    Grenada-:10
## 235                                 Mozambique-:10
## 236                                      Syria-:16
## 237                                 Timor-Leste-:1
## 238                                      Belize-:3
## 239                             Canada-Recovered:0
## 240                                       Laos-:10
## 241                                      Libya-:11
## 242                        West Bank and Gaza-:161
## 243                               Guinea-Bissau-:9
## 244                                       Mali-:36
## 245                       Saint Kitts and Nevis-:9
## 246                 Canada-Northwest Territories:2
## 247                                 Canada-Yukon:6
## 248                                    Kosovo-:125
## 249                                      Burma-:20
## 250                      United Kingdom-Anguilla:3
## 251        United Kingdom-British Virgin Islands:3
## 252      United Kingdom-Turks and Caicos Islands:5
## 253                                  MS Zaandam-:9
## 254                                    Botswana-:4
## 255                                     Burundi-:3
## 256                                Sierra Leone-:2
## 257 Netherlands-Bonaire, Sint Eustatius and Saba:2
## 258                                      Malawi-:3
```

```
map <- leaflet() %>% addTiles()
#marker
map %<>% addCircleMarkers(x$Long, x$Lat, radius = 2+log2(x$confirmed), stroke = F,
                          color = 'red', fillOpacity = 0.3, popup = x$txt)
map
```



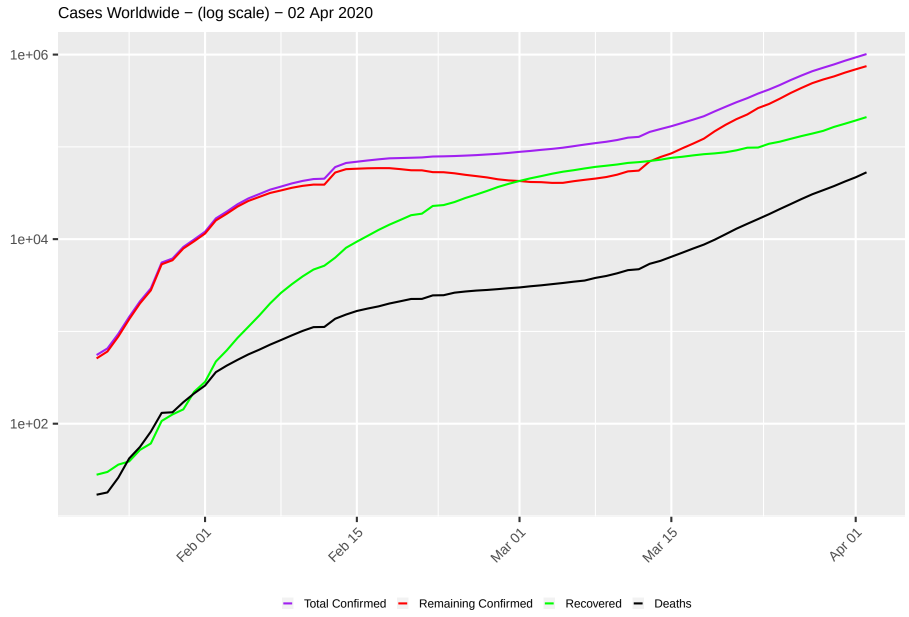
```
map %>% setView(5, 52,zoom = 6)
```



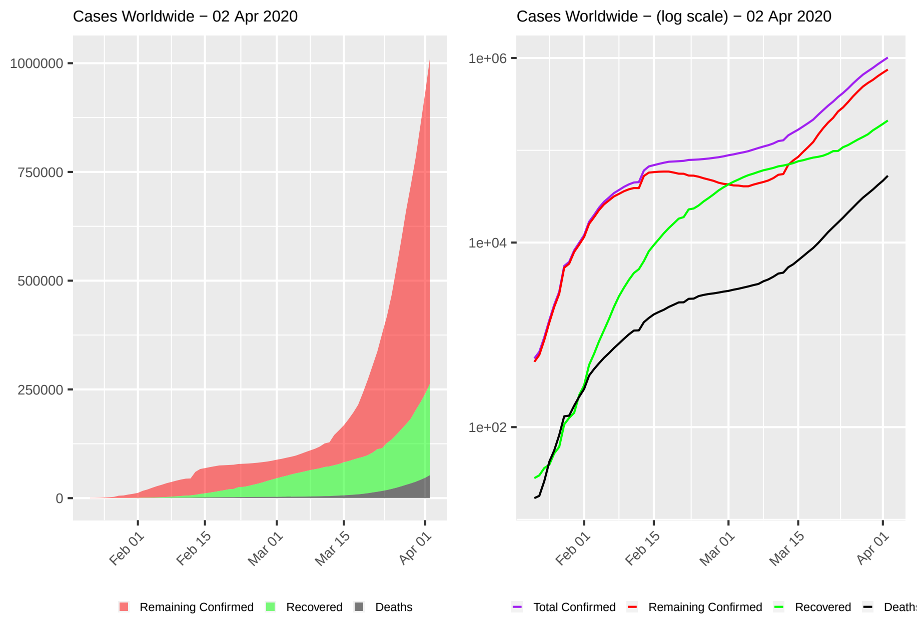
Number of cases:

```
world.long <- data.long %>% filter(country =='World') # can be also filtered for different
```

```
# area plot
plot1 <- world.long %>% filter(type != 'Total Confirmed') %>%
  ggplot(aes(x=date, y=count)) +
  geom_area(aes(fill=type), alpha=0.5) +
  labs(title=paste0('Cases Worldwide - ', max.date.txt)) +
  scale_fill_manual(values=c('red', 'green', 'black')) +
  theme(legend.title=element_blank(), legend.position='bottom',
        plot.title = element_text(size=8),
        axis.title.x=element_blank(),
        axis.title.y=element_blank(),
        legend.key.size=unit(0.2, 'cm'),
        legend.text=element_text(size=6),
        axis.text=element_text(size=7),
        axis.text.x=element_text(angle=45, hjust=1))


plot2 <- world.long %>%
  ggplot(aes(x=date,y=count)) +
  geom_line(aes(color=type)) +
  labs(title = paste0('Cases Worldwide - (log scale) - ', max.date.txt)) +
  scale_color_manual(values=c('purple', 'red', 'green', 'black')) +
  theme(legend.title=element_blank(), legend.position='bottom',
        plot.title = element_text(size =8),
        axis.title.x=element_blank(),
        axis.title.y = element_blank(),
        legend.key.size = unit(0.2, 'cm'),
        legend.text = element_text(size =6),
        axis.text = element_text(size = 7),
        axis.text.x =element_text(angle = 45, hjust = 1)) +
  scale_y_continuous(trans = 'log10')

plot2
```



```
grid.arrange(plot1, plot2, ncol=2)
```



Current confirmed Cases:

```r
data.world <- data %>% filter(country == 'World')
n <- nrow(data.world)

##current confirmed and daily new confirmed
plot1 <- ggplot(data.world, aes(x=date, y=remaining.confirmed)) +
  geom_point()+geom_smooth()+
  xlab('') + ylab('Count') + labs(title = 'Current Confirmed Cases') +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))

plot2 <- ggplot(data.world, aes(x=date, y=confirmed.new))+ geom_point() + geom_smooth() + xl
  theme(axis.text.x = element_text(angle =45, hjust=1))
```

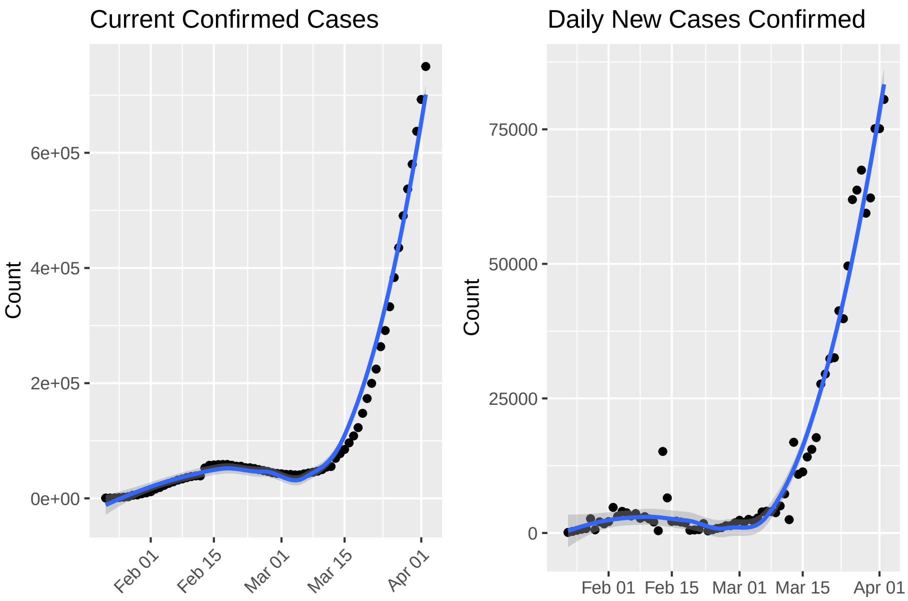
```
## List of 1
##  $ axis.text.x:List of 11
##   ..$ family       : NULL
##   ..$ face         : NULL
##   ..$ colour       : NULL
##   ..$ size         : NULL
##   ..$ hjust        : num 1
##   ..$ vjust        : NULL
##   ..$ angle        : num 45
##   ..$ lineheight   : NULL
##   ..$ margin       : NULL
##   ..$ debug        : NULL
##   ..$ inherit.blank: logi FALSE
##   ..- attr(*, "class")= chr [1:2] "element_text" "element"
##  - attr(*, "class")= chr [1:2] "theme" "gg"
##  - attr(*, "complete")= logi FALSE
##  - attr(*, "validate")= logi TRUE
```

```
grid.arrange(plot1, plot2, ncol=2)
```

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```

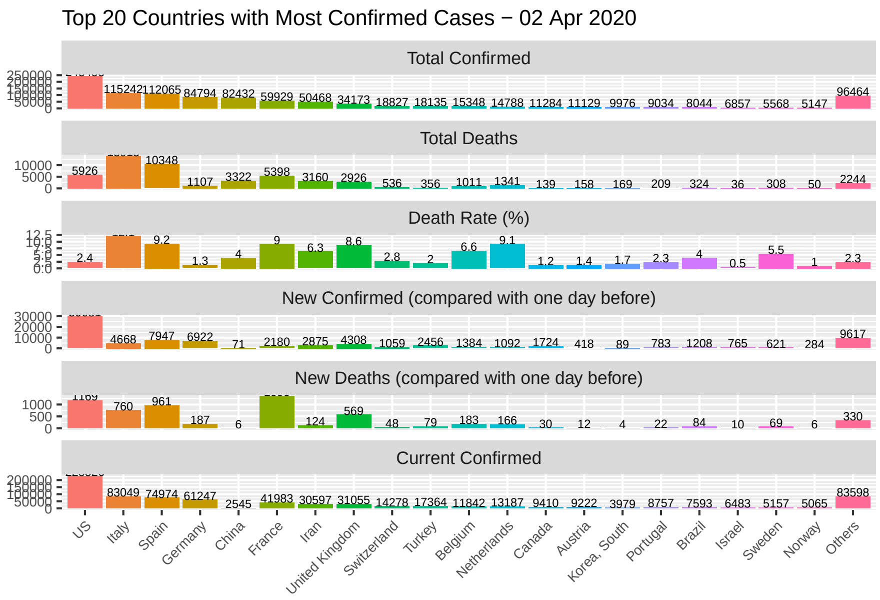
```
## Warning: Removed 1 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 1 rows containing missing values (geom_point).
```

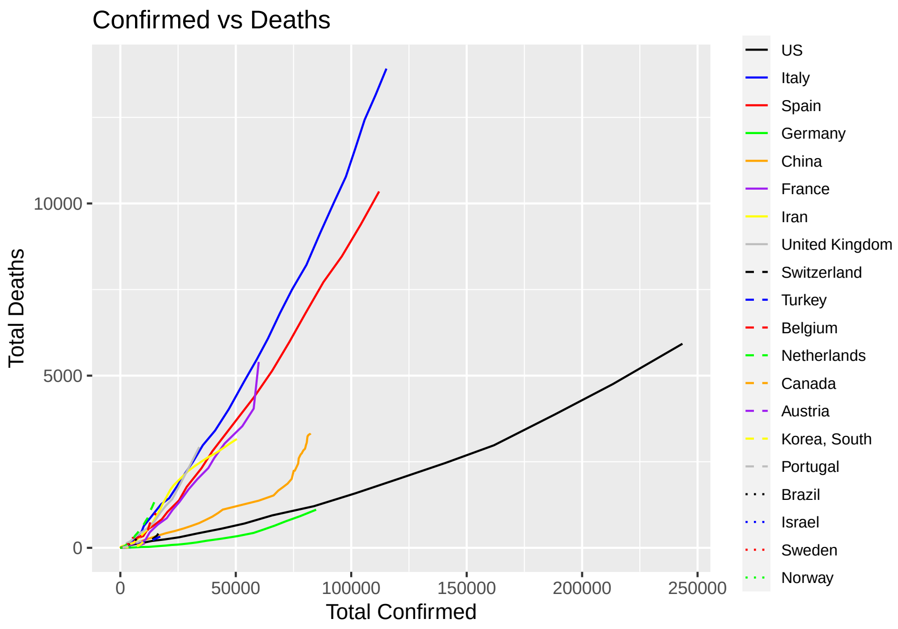


Bar Chart

```
data.latest.long <- data.latest %>% filter(country!='World') %>% gather(key=type, value=cou

data.latest.long %<>% mutate(type=recode_factor(type, confirmed='Total Confirmed', deaths='
## bar chart
data.latest.long %>% ggplot(aes(x=country, y=count, fill=country, group=country)) +
  geom_bar(stat='identity') +
  geom_text(aes(label=count, y=count),size=2, vjust=0) +
  xlab('') + ylab('') +
  labs(title=paste0('Top 20 Countries with Most Confirmed Cases - ', max.date.txt))+ scale_f
  theme(legend.title=element_blank(),
        legend.position='none',
        plot.title=element_text(size=11),axis.text=element_text(size=7), axis.text.x=element
```

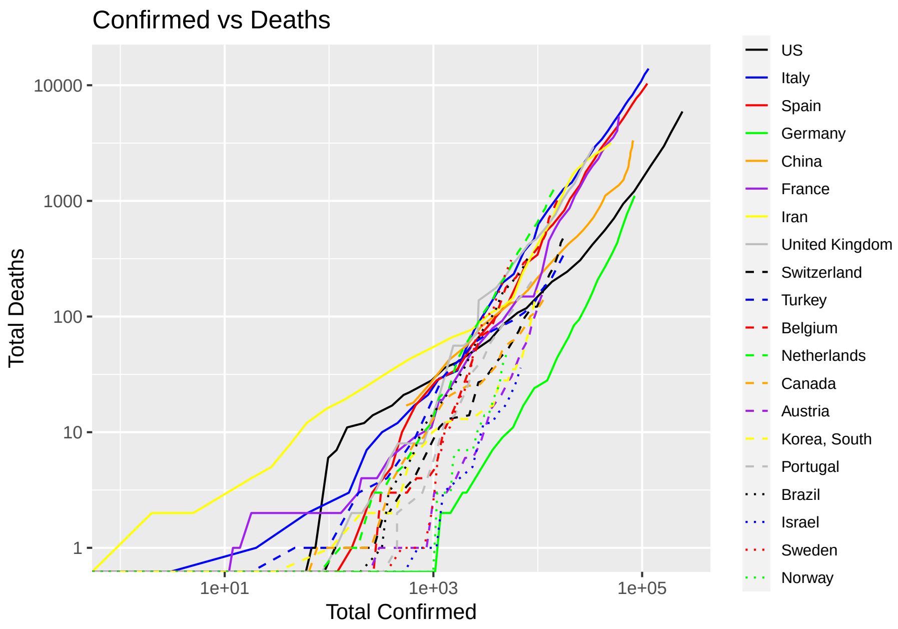


```
# Confirmed versus Deaths
linetypes <- rep(c("solid", "dashed", "dotted"), each=8)
colors <- rep(c('black', 'blue', 'red', 'green', 'orange', 'purple', 'yellow', 'grey'), 3)
df <- data %>% filter(country %in% setdiff(top.countries, c('World', 'Others'))) %>%
mutate(country=country %>% factor(levels=c(top.countries)))
vs <- df %>% ggplot(aes(x=confirmed, y=deaths, group=country)) +
  geom_line(aes(color=country, linetype=country)) +
  xlab('Total Confirmed') + ylab('Total Deaths') +
  scale_linetype_manual(values=linetypes) +
  scale_color_manual(values=colors) +
  theme(legend.title=element_blank(),
        legend.text=element_text(size=8),
        legend.key.size=unit(0.5, 'cm')) + ggtitle('Confirmed vs Deaths')
vs
```



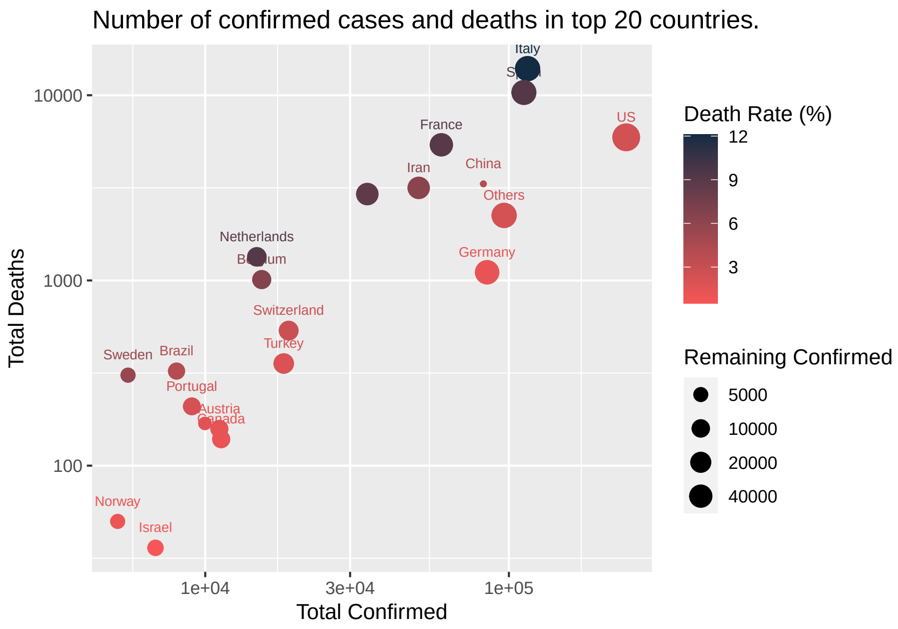
```
vs + scale_x_log10() + scale_y_log10()
```

```
## Warning: Transformation introduced infinite values in continuous x-axis

## Warning: Transformation introduced infinite values in continuous y-axis
```



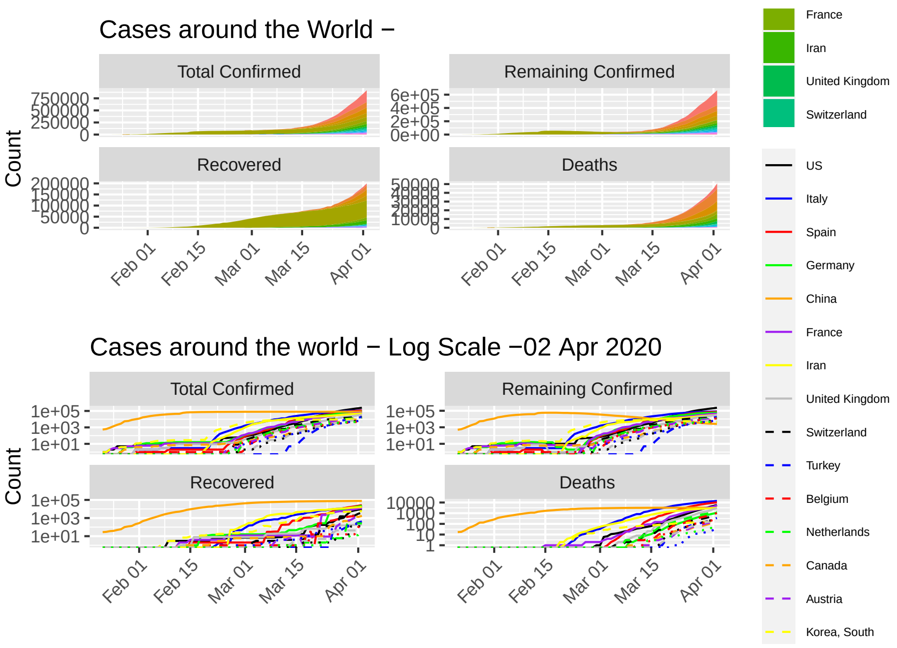
Number of confirmed cases and deaths in top 20 countries.

```
df <- data.latest %>% filter(country %in% setdiff(top.countries, 'World'))

plot1 <- df %>% ggplot(aes(x=confirmed, y=deaths, col=death.rate, size=remaining.confirmed))
scale_size(name='Remaining Confirmed', trans='log2', breaks=c(1e3, 2e3, 5e3, 1e4, 2e4, 4e4))
geom_text(aes(label=country), size=2.5, check_overlap=T, vjust=-1.6) +
geom_point() +
xlab('Total Confirmed') + ylab('Total Deaths') +
labs(col="Death Rate (%)") +
scale_color_gradient(low='#f75656', high='#132B43') +
scale_x_log10() + scale_y_log10()
plot1
```

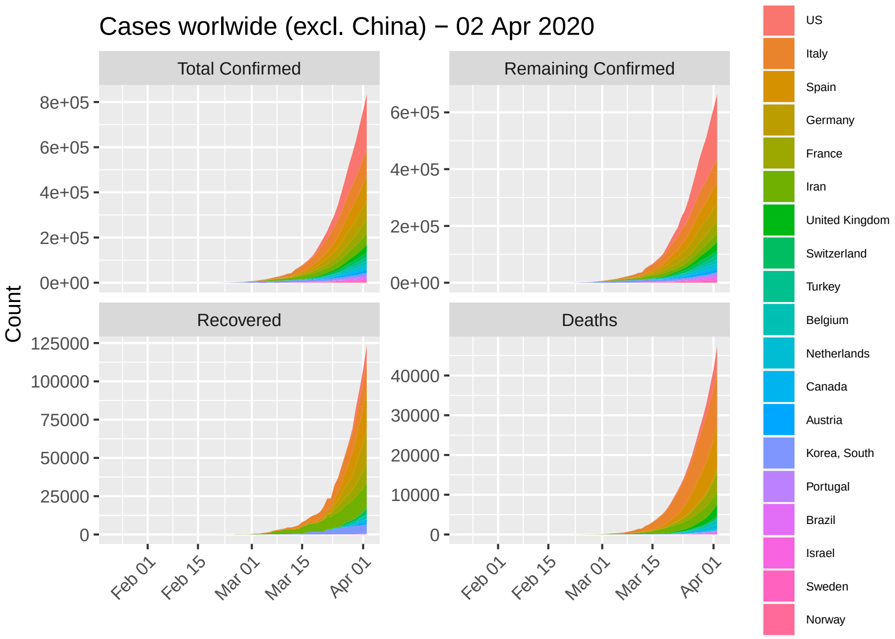


```
df <- data.long %>% filter(country %in% top.countries) %<>% mutate(country=country %>% facto

### CASES AROUND WORLD
p <- df%>% filter(country !='World') %>%
  ggplot(aes(x=date, y=count)) + xlab('') + ylab('Count') +
  theme(legend.title=element_blank(),
        legend.text = element_text(size=6),
        legend.key.size=unit(0.6, 'cm'),
        axis.text.x=element_text(angle = 45, hjust=1)) +
  facet_wrap(~type, ncol = 2, scale='free_y')
# area plot
plot1 <- p + geom_area(aes(fill=country)) +
  labs(title='Cases around the World - ', max.date.txt)

# line plot and in log scale
#linetypes <- rep(c('solid','dashed','dotted'), each=8)
#colors <- rep(c('black','blue','red','green','orange', 'purple', 'yellow', 'grey'), 3)
plot2 <- p + geom_line(aes(color=country, linetype=country)) +
  scale_linetype_manual(values = linetypes) +
  scale_color_manual(values = colors) +
  labs(title =paste0('Cases around the world - Log Scale -', max.date.txt)) +
  scale_y_continuous(trans = 'log10')
grid.arrange(plot1, plot2, ncol=1)
```

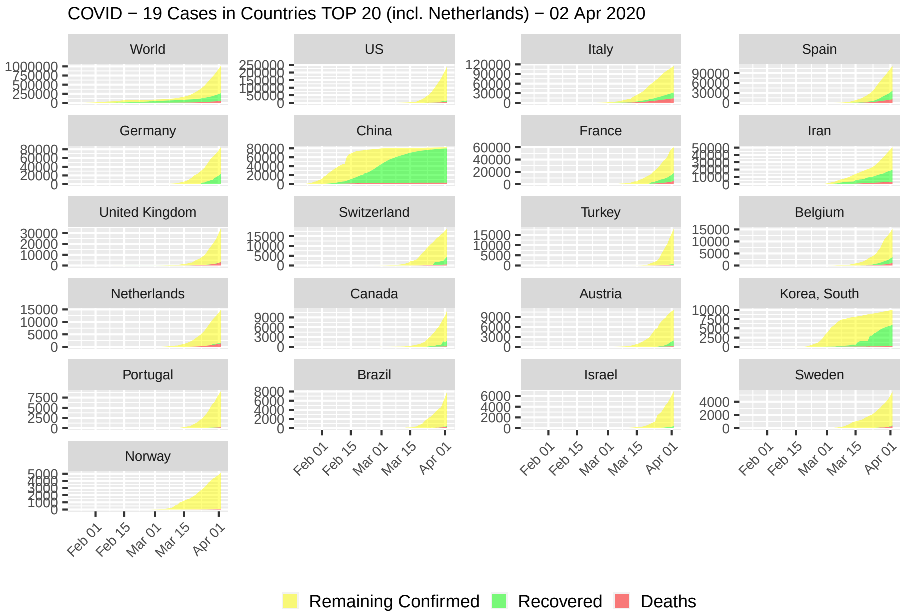
```
## Warning: Transformation introduced infinite values in continuous y-axis
```



```r
# Plot: excluding China
p <- df%>% filter(!(country %in% c('World', 'China'))) %>%
  ggplot(aes(x=date, y=count)) + xlab('') + ylab('Count') +
  theme(legend.title=element_blank(),
        legend.text = element_text(size=6),
        legend.key.size=unit(0.6, 'cm'),
        axis.text.x=element_text(angle = 45, hjust=1)) +
  facet_wrap(~type, ncol = 2, scale='free_y')
p + geom_area(aes(fill=country)) +
  labs(title=paste0('Cases worlwide (excl. China) - ', max.date.txt))
```



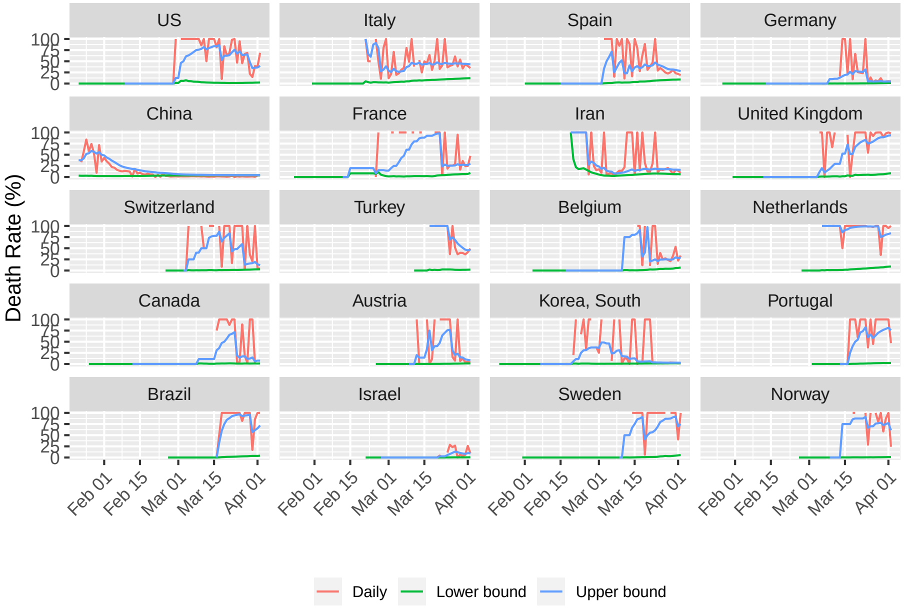
```
# # # list(countries) == 'Netherlands'

## If The Netherland is not top 20, add it in and remove 'Others'
if(!('Netherlands' %in% top.countries)) {
  top.countries %<>% setdiff('Others') %>% c('Netherlands')
  df <- data.long %>% filter(country %in% top.countries) %>%
    mutate(country=country %>% factor(levels = c(top.countries)))
}

# cases by country - area plot
df %>% filter(type != 'World' & type !='Total Confirmed') %>%
  ggplot(aes(x=date, y=count, fill=type)) +
  geom_area(alpha=0.5) +
  labs(title = paste0('COVID - 19 Cases in Countries TOP 20 (incl. Netherlands) - ', max.dat
  scale_fill_manual(values=c('yellow','green','red')) +
  theme(legend.title=element_blank(), legend.position='bottom',
        plot.title= element_text(size = 9),
        axis.title.x=element_blank(),
        axis.title.y = element_blank(),
        legend.key.size = unit(0.3, 'cm'),
        strip.text.x = element_text(size=7),
        axis.text=element_text(size = 7),
        axis.text.x = element_text(angle=45, hjust=1)) +
  facet_wrap(~country, ncol=4, scale='free_y') + facet_wrap(~country, ncol=4, scales = 'free
```



Deaths rate:

```
rate.max <- rates.long$count %>% max(na.rm=T)

df <- rates.long %>% filter(country %in% setdiff(top.countries, 'World')) %>%
  mutate(country=factor(country, levels=top.countries))

df %>% ggplot(aes(x=date, y=count, color=type)) +
  geom_line() +
  xlab('') + ylab('Death Rate (%)') +
  theme(legend.position='bottom', legend.title=element_blank(),
        legend.text=element_text(size=8),
        legend.key.size=unit(0.5, 'cm'),
        axis.text.x=element_text(angle=45, hjust=1)) +
ylim(c(0, 100)) +
facet_wrap(~country, ncol=4)
```

```
## Warning: Removed 36 row(s) containing missing values (geom_path).
```



Countries with Highest Death Rates

```
## sort the latest data by death rate, and if tie, by confirmed
df <- data %>% filter(date == max(date) & country != 'World' & confirmed >= 100) %>%
  select(country, confirmed, confirmed.new, remaining.confirmed,
         recovered, deaths, deaths.new, death.rate=rate.lower) %>%
  arrange(desc(death.rate, confirmed))

df %>% head(20) %>%
mutate(death.rate=death.rate %>% format(nsmall=1) %>% paste0('%')) %>%
  kable('latex', booktabs=T, row.names=T, align=c('l', rep('r', 7)),
        caption=paste0('Top 20 Countries with Highest Death Rates - ', max.date.txt), format
kable_styling(font_size=7, latex_options=c('striped', 'hold_position', 'repeat_header'))
```

Note that this is an developing story. Check back for updates.

Table 2: Top 20 Countries with Highest Death Rates - 02 Apr 2020

	country	confirmed	confirmed.new	remaining.confirmed	recovered	deaths	deaths.new	death.rate
1	San Marino	245	9	194	21	30	4	12.2%
2	Italy	115,242	4,668	83,049	18,278	13,915	760	12.1%
3	Congo (Kinshasa)	134	25	118	3	13	4	9.7%
4	Indonesia	1,790	113	1,508	112	170	13	9.5%
5	Spain	112,065	7,947	74,974	26,743	10,348	961	9.2%
6	Netherlands	14,788	1,092	13,187	260	1,341	166	9.1%
7	France	59,929	2,180	41,983	12,548	5,398	1,355	9.0%
8	Algeria	986	139	839	61	86	28	8.7%
9	United Kingdom	34,173	4,308	31,055	192	2,926	569	8.6%
10	Iraq	772	44	516	202	54	2	7.0%
11	Egypt	865	86	606	201	58	6	6.7%
12	Belgium	15,348	1,384	11,842	2,495	1,011	183	6.6%
13	Bolivia	123	8	114	1	8	1	6.5%
14	Honduras	219	47	202	3	14	4	6.4%
15	Iran	50,468	2,875	30,597	16,711	3,160	124	6.3%
16	Morocco	708	54	633	31	44	5	6.2%
17	Albania	277	18	185	76	16	1	5.8%
18	Burkina Faso	288	6	222	50	16	0	5.6%
19	Sweden	5,568	621	5,157	103	308	69	5.5%
20	Dominican Republic	1,380	96	1,304	16	60	3	4.3%