



# Analysis of Global COVID-19 Pandemic Data

Estimated time needed: **90** minutes

## Overview:

There are 10 tasks in this final project. All tasks will be graded by your peers who are also completing this assignment within the same session.

You need to submit the following the screenshot for the code and output for each task for review.

If you need to refresh your memories about specific coding details, you may refer to previous hands-on labs for code examples.

```
In [1]: # This Lab requires 'httr' and 'rvest' packages, which are already pre-loaded into t  
# However, if you are working on your Local RStudio, please uncomment the below cod  
  
#install.packages("httr")  
#install.packages("rvest")
```

```
In [28]: library(httr)  
library(rvest)
```

Note: if you can import above libraries, please use `install.packages()` to install them first.

## TASK 1: Get a COVID-19 pandemic Wiki page using HTTP request

First, let's write a function to use HTTP request to get a public COVID-19 Wiki page.

Before you write the function, you can open this public page from this

URL [https://en.wikipedia.org/w/index.php?title=Template:COVID-19\\_testing\\_by\\_country](https://en.wikipedia.org/w/index.php?title=Template:COVID-19_testing_by_country) using a web browser.

The goal of task 1 is to get the html page using HTTP request ( `httr` library)

```
In [44]: get_wiki_covid19_page <- function() {

  # Our target COVID-19 wiki page URL is: https://en.wikipedia.org/w/index.php?title=Template:COVID-19_testing_by_country
  # Which has two parts:
  # 1) base URL `https://en.wikipedia.org/w/index.php`
  # 2) URL parameter: `title=Template:COVID-19_testing_by_country`, seperated by `&`

  # Wiki page base
  wiki_base_url <- "https://en.wikipedia.org/w/index.php"
  body<-list(title="Template:COVID-19_testing_by_country")
  response<-GET(wiki_base_url, query = body)
  return(response)
  # You will need to create a List which has an element called `title` to specify what you want to search for
  # in our case, it will be `Template:COVID-19_testing_by_country`

  # - Use the `GET` function in httr Library with a `url` argument and a `query` argument
  # Use the `return` function to return the response

}
```

Call the `get_wiki_covid19_page` function to get a http response with the target html page

```
In [45]: # Call the get_wiki_covid19_page function and print the response
get_wiki_covid19_page()

Response [https://en.wikipedia.org/w/index.php?title=Template%3ACOVID-19_testing_by_country]
Date: 2024-04-11 20:28
Status: 200
Content-Type: text/html; charset=UTF-8
Size: 449 kB
<!DOCTYPE html>
<html class="client-nojs vector-feature-language-in-header-enabled vector-fea...
<head>
<meta charset="UTF-8">
<title>Template:COVID-19 testing by country - Wikipedia</title>
<script>(function(){var className="client-js vector-feature-language-in-heade...
"wgDigitTransformTable":["",""],"wgDefaultDateFormat":"dmy","wgMonthNames":["...
"CS1 uses Russian-language script (ru)","CS1 Russian-language sources (ru)","...
,"CS1 Lithuanian-language sources (lt)","CS1 Malagasy-language sources (mg)","...
"wgRelevantArticleId":63303421,"wgIsProbablyEditable":false,"wgRelevantPageIs...
...
...
```

## TASK 2: Extract COVID-19 testing data table from the wiki HTML page

On the COVID-19 testing wiki page, you should see a data table `<table>` node contains COVID-19 testing data by country on the page:

| COVID-19 testing statistics by country<br>[hide] |                     |            |                      |                   |                       |                        |                           |        |  |
|--|---------------------|------------|----------------------|-------------------|-----------------------|------------------------|---------------------------|--------|--|
| Country or region                                | Date <sup>[a]</sup> | Tested     | Units <sup>[b]</sup> | Confirmed (cases) | Confirmed / tested, % | Tested / population, % | Confirmed / population, % | Ref.   |  |
| Afghanistan                                      | 17 Dec 2020         | 154,767    | samples              | 49,621            | 32.1                  | 0.40                   | 0.13                      | [1]    |  |
| Albania  | 18 Feb 2021         | 426,654    | samples              | 96,838            | 22.6                  | 15.0                   | 3.4                       | [2]    |  |
| Algeria  | 2 Nov 2020          | 230,553    | samples              | 58,574            | 25.4                  | 0.53                   | 0.13                      | [3][4] |  |
| Andorra  | 15 Mar 2021         | 162,071    | samples              | 11,285            | 7.0                   | 209                    | 14.6                      | [5]    |  |
| Angola   | 12 Mar 2021         | 399,228    | samples              | 20,981            | 5.3                   | 1.3                    | 0.067                     | [6]    |  |
| Antigua and Barbuda                              | 6 Mar 2021          | 15,268     | samples              | 832               | 5.4                   | 15.9                   | 0.86                      | [7]    |  |
| Argentina  | 25 Mar 2021         | 8,517,821  | samples              | 2,278,115         | 26.7                  | 18.8                   | 5.0                       | [8]    |  |
| Armenia  | 25 Mar 2021         | 822,634    | samples              | 187,441           | 22.8                  | 27.9                   | 6.4                       | [9]    |  |
| Australia  | 25 Mar 2021         | 15,334,583 | samples              | 29,228            | 0.19                  | 61.1                   | 0.12                      | [10]   |  |
| Austria  | 25 Mar 2021         | 21,147,134 | samples              | 523,461           | 2.5                   | 238                    | 5.9                       | [11]   |  |
| Azerbaijan                                       | 24 Mar 2021         | 2,799,101  | samples              | 249,492           | 8.9                   | 28.3                   | 2.5                       | [12]   |  |
| Bahamas  | 23 Mar 2021         | 73,979     | samples              | 8,953             | 12.1                  | 19.2                   | 2.3                       | [13]   |  |
| Bahrain  | 24 Mar 2021         | 3,464,973  | samples              | 138,283           | 4.0                   | 221                    | 8.8                       | [14]   |  |
| Bangladesh                                       | 5 Mar 2021          | 4,119,031  | samples              | 549,184           | 13.3                  | 2.5                    | 0.33                      | [15]   |  |
| Barbados   | 24 Mar 2021         | 137,322    | samples              | 3,593             | 2.6                   | 48.2                   | 1.3                       | [16]   |  |
| Belarus  | 25 Mar 2021         | 5,272,490  | samples              | 314,993           | 6.0                   | 55.5                   | 3.3                       | [17]   |  |
| Belgium  | 25 Mar 2021         | 10,772,328 | samples              | 854,608           | 7.9                   | 93.5                   | 7.4                       | [18]   |  |
| Belize   | 24 Mar 2021         | 95,541     | samples              | 12,410            | 13.0                  | 23.4                   | 3.0                       | [19]   |  |
| Benin  | 23 Mar 2021         | 520,466    |                      | 6,501             | 1.2                   | 4.4                    | 0.055                     | [20]   |  |
| Bhutan   | 26 Mar 2021         | 586,497    | samples              | 870               | 0.15                  | 79.1                   | 0.12                      | [21]   |  |
| Bolivia  | 23 Mar 2021         | 856,948    | cases                | 266,086           | 31.1                  | 7.5                    | 2.3                       | [22]   |  |

Note the numbers you actually see on your page may be different from above because it is still an on-going pandemic when creating this notebook.

The goal of task 2 is to extract above data table and convert it into a data frame

Now use the `read_html` function in rvest library to get the root html node from response

```
In [46]: # Get the root html node from the http response in task 1
root_node <- read_html(get_wiki_covid19_page())
root_node
```

```
{html_document}
<html class="client-nojs vector-feature-language-in-header-enabled vector-feature-language-in-main-page-header-disabled vector-feature-sticky-header-disabled vector-feature-page-tools-pinned-disabled vector-feature-toc-pinned-clientpref-1 vector-feature-main-menu-pinned-disabled vector-feature-limited-width-clientpref-1 vector-feature-limited-width-content-enabled vector-feature-custom-font-size-clientpref-0 vector-feature-client-preferences-disabled vector-feature-client-prefs-pinned-disabled vector-feature-night-mode-disabled skin-night-mode-disabled vector-toc-available" lang="en" dir="ltr">
[1] <head>\n<meta http-equiv="Content-Type" content="text/html; charset=UTF-8 ...
[2] <body class="skin-vector skin-vector-search-vue mediawiki ltr sitedir-ltr ...
```

Get the tables in the HTML root node using `html_nodes` function.

```
In [47]: # Get the table node from the root html node
table_node <- html_nodes(root_node, "table")
table_node
```

```
{xml_nodeset (4)}
[1] <table class="box-Update plainlinks ombox ombox-content ambox-Update" rol ...
[2] <table class="wikitable plainrowheaders sortable collapsible autocollapse ...
[3] <table class="plainlinks ombox mbox-small ombox-notice" role="presentatio ...
[4] <table class="wikitable mw-templatedata-doc-params">\n<caption><p class=" ...
```

Read the specific table from the multiple tables in the `table_node` using the `html_table` function and convert it into dataframe using `as.data.frame`

*Hint:- Please read the `table_node` with index 2(ex:- `table_node[2]`).*

```
In [48]: # Read the table node and convert it into a data frame, and print the data frame for covid_data_frame <- html_table(table_node[2])
covid_df <- as.data.frame(covid_data_frame)
head(covid_df)
```

A data.frame: 6 × 9

|   | Country.or.region   | Date.a.     | Tested  | Units.b. | Confirmed.cases. | Confirmed..tested.. | Tested. |
|---|---------------------|-------------|---------|----------|------------------|---------------------|---------|
|   |                     | <chr>       | <chr>   | <chr>    | <chr>            | <chr>               | <chr>   |
| 1 | Afghanistan         | 17 Dec 2020 | 154,767 | samples  | 49,621           |                     | 32.1    |
| 2 | Albania             | 18 Feb 2021 | 428,654 | samples  | 96,838           |                     | 22.6    |
| 3 | Algeria             | 2 Nov 2020  | 230,553 | samples  | 58,574           |                     | 25.4    |
| 4 | Andorra             | 23 Feb 2022 | 300,307 | samples  | 37,958           |                     | 12.6    |
| 5 | Angola              | 2 Feb 2021  | 399,228 | samples  | 20,981           |                     | 5.3     |
| 6 | Antigua and Barbuda | 6 Mar 2021  | 15,268  | samples  | 832              |                     | 5.4     |

## TASK 3: Pre-process and export the extracted data frame

The goal of task 3 is to pre-process the extracted data frame from the previous step, and export it as a csv file

Let's get a summary of the data frame

```
In [49]: # Print the summary of the data frame
summary(covid_df)
```

```
Country.or.region      Date.a.          Tested        Units.b.
Length:173            Length:173       Length:173     Length:173
Class :character      Class :character  Class :character  Class :character
Mode  :character      Mode  :character   Mode  :character  Mode  :character
Confirmed.cases.     Confirmed..tested.. Tested..population..
Length:173            Length:173       Length:173
Class :character      Class :character  Class :character
Mode  :character      Mode  :character   Mode  :character
Confirmed..population.. Ref.
Length:173            Length:173
Class :character      Class :character
Mode  :character      Mode  :character
```

As you can see from the summary, the columns names are little bit different to understand and some column data types are not correct. For example, the `Tested` column shows as `character`.

As such, the data frame read from HTML table will need some pre-processing such as removing irrelevant columns, renaming columns, and convert columns into proper data types.

We have prepared a pre-processing function for you to convert the data frame but you can also try to write one by yourself

```
In [50]: preprocess_covid_data_frame <- function(data_frame) {

  shape <- dim(data_frame)

  # Remove the World row
  data_frame<-data_frame[!(data_frame$`Country.or.region` == "World"),]
  # Remove the last row
  data_frame <- data_frame[1:172, ]

  # We dont need the Units and Ref columns, so can be removed
  data_frame["Ref."] <- NULL
  data_frame["Units.b."] <- NULL

  # Renaming the columns
  names(data_frame) <- c("country", "date", "tested", "confirmed", "confirmed.tes

  # Convert column data types
  data_frame$country <- as.factor(data_frame$country)
  data_frame$date <- as.factor(data_frame$date)
  data_frame$tested <- as.numeric(gsub(",","",data_frame$tested))
  data_frame$confirmed <- as.numeric(gsub(",","",data_frame$confirmed))
  data_frame$"confirmed.tested.ratio" <- as.numeric(gsub(",","",data_frame$`confi
  data_frame$"tested.population.ratio" <- as.numeric(gsub(",","",data_frame$`test
  data_frame$"confirmed.population.ratio" <- as.numeric(gsub(",","",data_frame$c

  return(data_frame)
}
```

Call the `preprocess_covid_data_frame` function

```
In [51]: # call `preprocess_covid_data_frame` function and assign it to a new data frame
df<-preprocess_covid_data_frame(covid_df)
```

Get the summary of the processed data frame again

```
In [52]: # Print the summary of the processed data frame again
summary(df)
```

|                     | country | date           | tested |  |
|---------------------|---------|----------------|--------|--|
| Afghanistan         | : 1     | 2 Feb 2023     | : 6    | Min. : 3880  |
| Albania             | : 1     | 1 Feb 2023     | : 4    | 1st Qu.: 512037  |
| Algeria             | : 1     | 31 Jan 2023    | : 4    | Median : 3029859   |
| Andorra             | : 1     | 1 Mar 2021     | : 3    | Mean : 31377219  |
| Angola              | : 1     | 23 Jul 2021    | : 3    | 3rd Qu.: 12386725  |
| Antigua and Barbuda | : 1     | 29 Jan 2023    | : 3    | Max. : 929349291   |
| (Other)             | :166    | (Other)        | :149   |  |
|                     |         |                |        | confirmed.confirmed.tested.ratio tested.population.ratio |
| Min. : 0            |         | Min. : 0.00    |        | Min. : 0.006   |
| 1st Qu.: 37839      |         | 1st Qu.: 5.00  |        | 1st Qu.: 9.475   |
| Median : 281196     |         | Median : 10.05 |        | Median : 46.950  |
| Mean : 2508340      |         | Mean : 11.25   |        | Mean : 175.504   |
| 3rd Qu.: 1278105    |         | 3rd Qu.: 15.25 |        | 3rd Qu.: 156.500   |
| Max. : 90749469     |         | Max. : 46.80   |        | Max. : 3223.000  |
|                     |         |                |        | confirmed.population.ratio                               |
| Min. : 0.000        |         |                |        |  |
| 1st Qu.: 0.425      |         |                |        |  |
| Median : 6.100      |         |                |        |  |
| Mean : 12.769       |         |                |        |  |
| 3rd Qu.: 16.250     |         |                |        |  |
| Max. : 74.400       |         |                |        |  |

After pre-processing, you can see the columns and column names are simplified, and columns types are converted into correct types.

The data frame has following columns:

- **country** - The name of the country
- **date** - Reported date
- **tested** - Total tested cases by the reported date
- **confirmed** - Total confirmed cases by the reported date
- **confirmed.tested.ratio** - The ratio of confirmed cases to the tested cases
- **tested.population.ratio** - The ratio of tested cases to the population of the country
- **confirmed.population.ratio** - The ratio of confirmed cases to the population of the country

OK, we can call `write.csv()` function to save the csv file into a file.

```
In [53]: # Export the data frame to a csv file
write.csv(df, file="covid.csv", row.names = FALSE)
```

Note for IBM Watson Studio, there is no traditional "hard disk" associated with a R workspace.

Even if you call `write.csv()` method to save the data frame as a csv file, it won't be shown in IBM Cloud Object Storage asset UI automatically.

However, you may still check if the `covid.csv` exists using following code snippet:

```
In [54]: # Get working directory  
wd <- getwd()  
# Get exported  
file_path <- paste(wd, sep="", "/covid.csv")  
# File path  
print(file_path)  
file.exists(file_path)
```

```
[1] "/resources/labs/RP0101EN/covid.csv"
```

```
TRUE
```

**Optional Step:** If you have difficulties finishing above webscraping tasks, you may still continue with next tasks by downloading a provided csv file from here:

```
In [55]: ## Download a sample csv file  
covid_csv_file <- download.file("https://cf-courses-data.s3.us.cloud-object-storage  
covid_data_frame_csv <- read.csv("covid.csv", header=TRUE, sep=",")
```

## TASK 4: Get a subset of the extracted data frame

The goal of task 4 is to get the 5th to 10th rows from the data frame with only `country` and `confirmed` columns selected

```
In [58]: # Read covid_data_frame_csv from the csv file  
covid_data_frame_csv <- read.csv("covid.csv")  
# Get the 5th to 10th rows, with two "country" "confirmed" columns  
covid_data_frame_csv[5:10, c('country', 'confirmed')]
```

A data.frame: 6 × 2

|    | country             | confirmed |
|----|---------------------|-----------|
|    | <fct>               | <int>     |
| 5  | Angola              | 20981     |
| 6  | Antigua and Barbuda | 832       |
| 7  | Argentina           | 2195722   |
| 8  | Armenia             | 177104    |
| 9  | Australia           | 29130     |
| 10 | Austria             | 488007    |

## TASK 5: Calculate worldwide COVID testing positive ratio

The goal of task 5 is to get the total confirmed and tested cases worldwide, and try to figure the overall positive ratio using `confirmed cases / tested cases`

```
In [61]: # Get the total confirmed cases worldwide
total_confirmed <- sum(covid_data_frame_csv['confirmed'])
total_confirmed
# Get the total tested cases worldwide
total_tested <- sum(covid_data_frame_csv['tested'])
total_tested
# Get the positive ratio (confirmed / tested)
positive_ratio <- (total_confirmed/total_tested)
positive_ratio
```

117313932

1698581244

0.0690658350399164

## TASK 6: Get a country list which reported their testing data

The goal of task 6 is to get a catalog or sorted list of countries who have reported their COVID-19 testing data

```
In [68]: # Get the `country` column
countries <- covid_data_frame_csv$country
# Check its class (should be Factor)
class(covid_data_frame_csv$country)
# Convert the country column into character so that you can easily sort them
countries <- as.character(countries)
class(countries)
# Sort the countries AtoZ
```

```

sort_countryAscending <- sort(countries)
# Sort the countries ZtoA
sort_countryDescending <- sort(countries, decreasing=TRUE)
# Print the sorted ZtoA list
sort_countryDescending

'factor'
'character'

'Zimbabwe' · 'Zambia' · 'Vietnam' · 'Venezuela' · 'Uzbekistan' · 'Uruguay' · 'United States' ·
'United Kingdom' · 'United Arab Emirates' · 'Ukraine' · 'Uganda' · 'Turkey' · 'Tunisia' ·
'Trinidad and Tobago' · 'Togo' · 'Thailand' · 'Tanzania' · 'Taiwan[m]' · 'Switzerland[l]' · 'Sweden' ·
'Sudan' · 'Sri Lanka' · 'Spain' · 'South Sudan' · 'South Korea' · 'South Africa' · 'Slovenia' ·
'Slovakia' · 'Singapore' · 'Serbia' · 'Senegal' · 'Saudi Arabia' · 'San Marino' · 'Saint Vincent' ·
'Saint Lucia' · 'Saint Kitts and Nevis' · 'Rwanda' · 'Russia' · 'Romania' · 'Qatar' · 'Portugal' ·
'Poland' · 'Philippines' · 'Peru' · 'Paraguay' · 'Papua New Guinea' · 'Panama' · 'Palestine' ·
'Pakistan' · 'Oman' · 'Norway' · 'Northern Cyprus[k]' · 'North Macedonia' · 'North Korea' ·
'Nigeria' · 'Niger' · 'New Zealand' · 'New Caledonia' · 'Netherlands' · 'Nepal' · 'Namibia' ·
'Myanmar' · 'Mozambique' · 'Morocco' · 'Montenegro' · 'Mongolia' · 'Moldova[j]' · 'Mexico' ·
'Mauritius' · 'Mauritania' · 'Malta' · 'Mali' · 'Maldives' · 'Malaysia' · 'Malawi' · 'Madagascar' ·
'Luxembourg[i]' · 'Lithuania' · 'Libya' · 'Liberia' · 'Lesotho' · 'Lebanon' · 'Latvia' · 'Laos' ·
'Kyrgyzstan' · 'Kuwait' · 'Kosovo' · 'Kenya' · 'Kazakhstan' · 'Jordan' · 'Japan' · 'Jamaica' ·
'Ivory Coast' · 'Italy' · 'Israel' · 'Ireland' · 'Iraq' · 'Iran' · 'Indonesia' · 'India' · 'Iceland' · 'Hungary' ·
'Honduras' · 'Haiti' · 'Guyana' · 'Guinea-Bissau' · 'Guinea' · 'Guatemala' · 'Grenada' · 'Greenland' ·
'Greece' · 'Ghana' · 'Germany' · 'Georgia[h]' · 'Gambia' · 'Gabon' · 'France[f][g]' · 'Finland' · 'Fiji' ·
'Faroe Islands' · 'Ethiopia' · 'Eswatini' · 'Estonia' · 'Equatorial Guinea' · 'El Salvador' · 'Egypt' ·
'Ecuador' · 'DR Congo' · 'Dominican Republic' · 'Dominica' · 'Djibouti' · 'Denmark[e]' · 'Czechia' ·
'Cyprus[d]' · 'Cuba' · 'Croatia' · 'Costa Rica' · 'Colombia' · 'China[c]' · 'Chile' · 'Chad' · 'Canada' ·
'Cameroon' · 'Cambodia' · 'Burundi' · 'Burkina Faso' · 'Bulgaria' · 'Brunei' · 'Brazil' · 'Botswana' ·
'Bosnia and Herzegovina' · 'Bolivia' · 'Bhutan' · 'Benin' · 'Belize' · 'Belgium' · 'Belarus' · 'Barbados' ·
'Bangladesh' · 'Bahrain' · 'Bahamas' · 'Azerbaijan' · 'Austria' · 'Australia' · 'Armenia' · 'Argentina' ·
'Antigua and Barbuda' · 'Angola' · 'Andorra' · 'Algeria' · 'Albania' · 'Afghanistan'

```

## TASK 7: Identify countries names with a specific pattern

The goal of task 7 is using a regular expression to find any countries start with `United`

```

In [70]: # Use a regular expression `United.+` to find matches
matched_country <- grep("United.+", countries, value=TRUE)
# Print the matched country names
matched_country

```

'United Arab Emirates' · 'United Kingdom' · 'United States'

## TASK 8: Pick two countries you are interested, and then review their testing data

The goal of task 8 is to compare the COVID-19 test data between two countries, you will need to select two rows from the dataframe, and select `country`, `confirmed`, `confirmed-population-ratio` columns

```
In [71]: # Select a subset (should be only one row) of data frame based on a selected country
uk_data <- covid_data_frame_csv[165, c("country", "confirmed", "confirmed.population.ratio")]
uk_data
# Select a subset (should be only one row) of data frame based on a selected country
us_data <- covid_data_frame_csv[166, c("country", "confirmed", "confirmed.population.ratio")]
us_data
```

A data.frame: 1 × 3

| country | confirmed | confirmed.population.ratio |
|---------|-----------|----------------------------|
|---------|-----------|----------------------------|

|            | <fct>          | <int>   | <dbl> |
|------------|----------------|---------|-------|
| <b>165</b> | United Kingdom | 4248286 | 6.3   |

A data.frame: 1 × 3

| country | confirmed | confirmed.population.ratio |
|---------|-----------|----------------------------|
|---------|-----------|----------------------------|

|            | <fct>         | <int>    | <dbl> |
|------------|---------------|----------|-------|
| <b>166</b> | United States | 29403102 | 8.9   |

## TASK 9: Compare which one of the selected countries has a larger ratio of confirmed cases to population

The goal of task 9 is to find out which country you have selected before has larger ratio of confirmed cases to population, which may indicate that country has higher COVID-19 infection risk

```
In [72]: # Use if-else statement
# if (check which confirmed.population value is greater) {
#   print()
# } else {
#   print()
# }
if (us_data$confirmed.population.ratio > uk_data$confirmed.population.ratio) {
  print("United State has a larger ratio of confirmed cases to population")
} else {
  print("United Kingdom has a larger ratio of confirmed cases to population")
```

[1] "United State has a larger ratio of confirmed cases to population"

## TASK 10: Find countries with confirmed to population ratio rate less than a threshold

The goal of task 10 is to find out which countries have the confirmed to population ratio less than 1%, it may indicate the risk of those countries are relatively low

```
In [73]: # Get a subset of any countries with `confirmed.population.ratio` Less than the threshold
covid_data_frame_csv[covid_data_frame_csv$confirmed.population.ratio < 1, ]
```

A data.frame: 78 × 7

|    | country             | date        | tested    | confirmed | confirmed.tested.ratio | tested.population.rati |
|----|---------------------|-------------|-----------|-----------|------------------------|------------------------|
|    | <fct>               | <fct>       | <dbl>     | <int>     | <dbl>                  | <dbl>                  |
| 1  | Afghanistan         | 17 Dec 2020 | 154767    | 49621     | 32.100                 | 0.4                    |
| 3  | Algeria             | 2 Nov 2020  | 230553    | 58574     | 25.400                 | 0.5                    |
| 5  | Angola              | 12 Mar 2021 | 399228    | 20981     | 5.300                  | 1.1                    |
| 6  | Antigua and Barbuda | 6 Mar 2021  | 15268     | 832       | 5.400                  | 15.9                   |
| 9  | Australia           | 15 Mar 2021 | 14933604  | 29130     | 0.200                  | 59.5                   |
| 14 | Bangladesh          | 5 Mar 2021  | 4119031   | 549184    | 13.300                 | 2.5                    |
| 19 | Benin               | 3 Mar 2021  | 504345    | 6071      | 1.200                  | 4.3                    |
| 20 | Bhutan              | 14 Mar 2021 | 562368    | 868       | 0.150                  | 75.8                   |
| 25 | Brunei              | 14 Mar 2021 | 110176    | 199       | 0.180                  | 24.0                   |
| 27 | Burkina Faso        | 4 Mar 2021  | 158777    | 12123     | 7.600                  | 0.7                    |
| 28 | Burundi             | 5 Jan 2021  | 90019     | 884       | 0.980                  | 0.1                    |
| 29 | Cambodia            | 2 Mar 2021  | 499716    | 844       | 0.170                  | 3.1                    |
| 30 | Cameroon            | 18 Feb 2021 | 942685    | 32681     | 3.500                  | 3.6                    |
| 32 | Chad                | 2 Mar 2021  | 99027     | 4020      | 4.100                  | 0.7                    |
| 34 | China[c]            | 31 Jul 2020 | 160000000 | 87655     | 0.055                  | 11.1                   |
| 38 | Cuba                | 13 Mar 2021 | 2649946   | 61472     | 2.300                  | 23.4                   |

|     | country           | date        | tested  | confirmed | confirmed.tested.ratio | tested.population.rat |
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| 42  | Djibouti          | 14 Mar 2021 | 120124  | 6268      | 5.200                  | 13.0                  |
| 43  | Dominica          | 11 Mar 2021 | 12325   | 156       | 1.300                  | 17.2                  |
| 45  | DR Congo          | 28 Feb 2021 | 124838  | 25961     | 20.800                 | 0.1                   |
| 47  | Egypt             | 9 Mar 2021  | 2423820 | 187716    | 7.700                  | 2.4                   |
| 48  | El Salvador       | 12 Mar 2021 | 799510  | 62086     | 7.800                  | 12.3                  |
| 49  | Equatorial Guinea | 6 Mar 2021  | 101117  | 6371      | 6.300                  | 7.7                   |
| 52  | Ethiopia          | 5 Mar 2021  | 2165507 | 164073    | 7.600                  | 1.9                   |
| 54  | Fiji              | 1 Mar 2021  | 30607   | 59        | 0.190                  | 3.4                   |
| 57  | Gabon             | 5 Mar 2021  | 545881  | 15517     | 2.800                  | 1.8                   |
| 58  | Gambia            | 15 Feb 2021 | 43217   | 4469      | 10.300                 | 2.0                   |
| 61  | Ghana             | 2 Mar 2021  | 917581  | 85742     | 9.300                  | 3.0                   |
| 63  | Greenland         | 12 Mar 2021 | 19902   | 31        | 0.160                  | 35.5                  |
| 64  | Grenada           | 3 Feb 2021  | 20288   | 148       | 0.730                  | 18.2                  |
| 66  | Guinea            | 4 Mar 2021  | 357161  | 16420     | 4.600                  | 2.7                   |
| :   | :                 | :           | :       | :         | :                      | :                     |
| 108 | Montenegro        | 4 Aug 2020  | 24469   | 3361      | 13.700                 | 3.900                 |
| 110 | Mozambique        | 3 Mar 2021  | 428868  | 60395     | 14.100                 | 1.400                 |

|     | country               | date        | tested  | confirmed | confirmed.tested.ratio | tested.population.rat |
|-----|-----------------------|-------------|---------|-----------|------------------------|-----------------------|
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| 111 | Myanmar               | 2 Mar 2021  | 2493481 | 141965    | 5.700                  | 4.600                 |
| 113 | Nepal                 | 1 Mar 2021  | 2165985 | 274216    | 12.700                 | 7.700                 |
| 115 | New Caledonia         | 9 Mar 2021  | 23793   | 70        | 0.290                  | 8.800                 |
| 116 | New Zealand           | 14 Mar 2021 | 1818986 | 2067      | 0.110                  | 36.500                |
| 117 | Niger                 | 22 Feb 2021 | 79321   | 4740      | 6.000                  | 0.350                 |
| 118 | Nigeria               | 28 Feb 2021 | 1544008 | 155657    | 10.100                 | 0.750                 |
| 119 | North Korea           | 25 Nov 2020 | 16914   | 0         | 0.000                  | 0.066                 |
| 124 | Pakistan              | 5 Mar 2021  | 9173593 | 588728    | 6.400                  | 4.200                 |
| 127 | Papua New Guinea      | 17 Feb 2021 | 47490   | 961       | 2.000                  | 0.530                 |
| 130 | Philippines           | 9 Mar 2021  | 9098973 | 600428    | 6.600                  | 9.000                 |
| 136 | Rwanda                | 9 Mar 2021  | 1043645 | 19779     | 1.900                  | 8.100                 |
| 137 | Saint Kitts and Nevis | 14 Mar 2021 | 10465   | 43        | 0.410                  | 20.000                |
| 142 | Senegal               | 1 Mar 2021  | 419545  | 34732     | 8.300                  | 2.600                 |
| 148 | South Korea           | 1 Mar 2021  | 6592010 | 90029     | 1.400                  | 12.700                |
| 149 | South Sudan           | 4 Mar 2021  | 113686  | 8527      | 7.500                  | 0.890                 |
| 151 | Sri Lanka             | 12 Mar 2021 | 2230759 | 87286     | 3.900                  | 10.200                |

|     | country             | date        | tested  | confirmed | confirmed.tested.ratio | tested.population.rat |
|-----|---------------------|-------------|---------|-----------|------------------------|-----------------------|
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| 152 | Sudan               | 7 Jan 2021  | 158804  | 23316     | 14.700                 | 0.360                 |
| 155 | Taiwan[m]           | 3 Mar 2021  | 429603  | 955       | 0.220                  | 1.800                 |
| 156 | Tanzania            | 18 Nov 2020 | 3880    | 509       | 13.100                 | 0.006                 |
| 157 | Thailand            | 4 Mar 2021  | 1579597 | 26162     | 1.700                  | 2.300                 |
| 158 | Togo                | 5 Mar 2021  | 242657  | 7428      | 3.100                  | 2.800                 |
| 159 | Trinidad and Tobago | 7 Mar 2021  | 98965   | 7736      | 7.800                  | 7.300                 |
| 162 | Uganda              | 11 Feb 2021 | 852444  | 39979     | 4.700                  | 1.900                 |
| 168 | Uzbekistan          | 14 Jul 2020 | 1400000 | 13872     | 0.990                  | 4.100                 |
| 169 | Venezuela           | 11 Mar 2021 | 2987875 | 144277    | 4.800                  | 10.300                |
| 170 | Vietnam             | 7 Mar 2021  | 2598753 | 2512      | 0.097                  | 2.600                 |
| 171 | Zambia              | 3 Mar 2021  | 1106204 | 80090     | 7.200                  | 6.400                 |
| 172 | Zimbabwe            | 5 Mar 2021  | 392323  | 36248     | 9.200                  | 2.600                 |