Covid19 Vaccine Analysis

Many vaccines have been introduced so far to fight covid-19. No vaccine has guaranteed 100% accuracy so far, but most manufacturing companies claim their vaccine is not 100% accurate, but still, it will save your life by giving you immunity.

Thus, each country tries to vaccinate a large part of its population so as not to depend on a single vaccine. That’s I am going to analysis in this project, which is how many vaccines each country is using to fight covid-19. In the section below, I have made my project on Covid-19 vaccines analysis with Python.

Importing the necessary Python libraries and the dataset

In [3]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
data = pd.read_csv("country_vaccinations.csv")
data.head()
```

Out[3]:

	country	iso_code	date	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_vaccinations	total_vaccir
0	Afghanistan	AFG	22-02-2021	0.0	0.0	NaN	NaN	NaN	
1	Afghanistan	AFG	23-02-2021	NaN	NaN	NaN	NaN	1367.0	
2	Afghanistan	AFG	24-02-2021	NaN	NaN	NaN	NaN	1367.0	
3	Afghanistan	AFG	25-02-2021	NaN	NaN	NaN	NaN	1367.0	
4	Afghanistan	AFG	26-02-2021	NaN	NaN	NaN	NaN	1367.0	

Exploring this data before we start analyzing the vaccines taken by countries

In [4]:

```
data.describe()
```

Out[4]:

	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_vaccinations	total_vaccinations_per_hundred	peo
count	9.325000e+03	8.649000e+03	6.425000e+03	7.830000e+03	1.530700e+04	9325.000000	
mean	5.180765e+06	3.271412e+06	1.645949e+06	1.359830e+05	7.910911e+04	15.928546	
std	2.131066e+07	1.221271e+07	7.123496e+06	5.231930e+05	3.616686e+05	23.530195	
min	0.000000e+00	0.000000e+00	1.000000e+00	0.000000e+00	0.000000e+00	0.000000	
25%	6.208300e+04	5.349000e+04	2.410700e+04	3.020500e+03	9.175000e+02	1.390000	
50%	4.419760e+05	3.380570e+05	1.792920e+05	1.603550e+04	6.506000e+03	6.590000	
75%	1.988844e+06	1.380430e+06	7.142100e+05	6.341400e+04	2.987550e+04	20.610000	
max	2.896270e+08	1.485629e+08	1.073465e+08	1.160100e+07	7.205286e+06	211.080000	

In [5]:

```
pd.to_datetime(data.date)
```

Out[5]:

```
0       2021-02-22
1       2021-02-23
2       2021-02-24
3       2021-02-25
4       2021-02-26
           ...
15500   2021-04-30
15501   2021-01-05
15502   2021-02-05
15503   2021-03-05
15504   2021-04-05
Name: date, Length: 15505, dtype: datetime64[ns]
```

In [6]:
```
data.country.value_counts()
```

Out[6]:
```
Canada           143
Russia           142
China            142
Israel           138
United States    137
                ...
Djibouti           1
Libya              1
Timor              1
Congo              1
Somalia            1
Name: country, Length: 195, dtype: int64
```

The United Kingdom is made up of England, Scotland, Wales, and Northern Ireland. But in the above data, these countries are mentioned separately with the same values as in the United Kingdom. So this may be an error while recording this data. So for fixing this error:

In [7]:
```
data = data[data.country.apply(lambda x: x not in ["England", "Scotland", "Wales", "Northern Ireland"])]
data.country.value_counts()
```

Out[7]:
```
Canada           143
Russia           142
China            142
Israel           138
United States    137
                ...
Timor              1
Libya              1
Somalia            1
Congo              1
Djibouti           1
Name: country, Length: 191, dtype: int64
```

Exploring the vaccines available in this dataset

In [8]:
```
data.vaccines.value_counts()
```

Out[8]:
```
Oxford/AstraZeneca                                                                    2574
Moderna, Oxford/AstraZeneca, Pfizer/BioNTech                                          1886
Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech                         1522
Oxford/AstraZeneca, Pfizer/BioNTech                                                   1402
Pfizer/BioNTech                                                                       1216
Moderna, Pfizer/BioNTech                                                               594
Oxford/AstraZeneca, Sinopharm/Beijing                                                  585
Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac                                           495
Oxford/AstraZeneca, Sinovac                                                            467
Sputnik V                                                                              436
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V                      404
Pfizer/BioNTech, Sinovac                                                               388
Oxford/AstraZeneca, Sinopharm/Beijing, Sputnik V                                       310
Sinopharm/Beijing                                                                      289
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing                                 238
Pfizer/BioNTech, Sinopharm/Beijing                                                     200
Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V                                192
Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac                                         165
Sinopharm/Beijing, Sputnik V                                                           149
EpiVacCorona, Sputnik V                                                                142
Sinopharm/Beijing, Sinopharm/Wuhan, Sinovac                                            142
Johnson&Johnson, Moderna, Pfizer/BioNTech                                              137
CanSino, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V                       132
Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V             129
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinopharm/Wuhan, Sputnik V     121
Covaxin, Oxford/AstraZeneca                                                            111
Oxford/AstraZeneca, Sputnik V                                                          111
Moderna, Oxford/AstraZeneca                                                            110
CanSino, Sinopharm/Beijing, Sinovac, Sputnik V                                          92
Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V                                          79
Johnson&Johnson                                                                         78
Pfizer/BioNTech, Sputnik V                                                              67
Pfizer/BioNTech, Sinovac, Sputnik V                                                     53
Oxford/AstraZeneca, Sinovac, Sputnik V                                                   1
Name: vaccines, dtype: int64
```

So we have almost all the Covid-19 vaccines available in this dataset. Now I will create a new DataFrame by only selecting the vaccine and the country columns to explore which vaccine is taken by which country:

In [9]:
```
df = data[['vaccines', 'country']]
df.head()
```

Out[9]:

	vaccines	country
0	Oxford/AstraZeneca	Afghanistan
1	Oxford/AstraZeneca	Afghanistan
2	Oxford/AstraZeneca	Afghanistan
3	Oxford/AstraZeneca	Afghanistan
4	Oxford/AstraZeneca	Afghanistan

Now let’s see how many countries are taking each of the vaccines mentioned in this data:

In [10]:

```
dict_ = {}
for i in df.vaccines.unique():
    dict_[i] = [df['country'][j] for j in df[df['vaccines'] == i].index]


vaccines = {}
for key, value in dict_.items():
    vaccines[key] = set(value)
for i,j in vaccines.items():
    print(f'{i}:>>{j}')
```

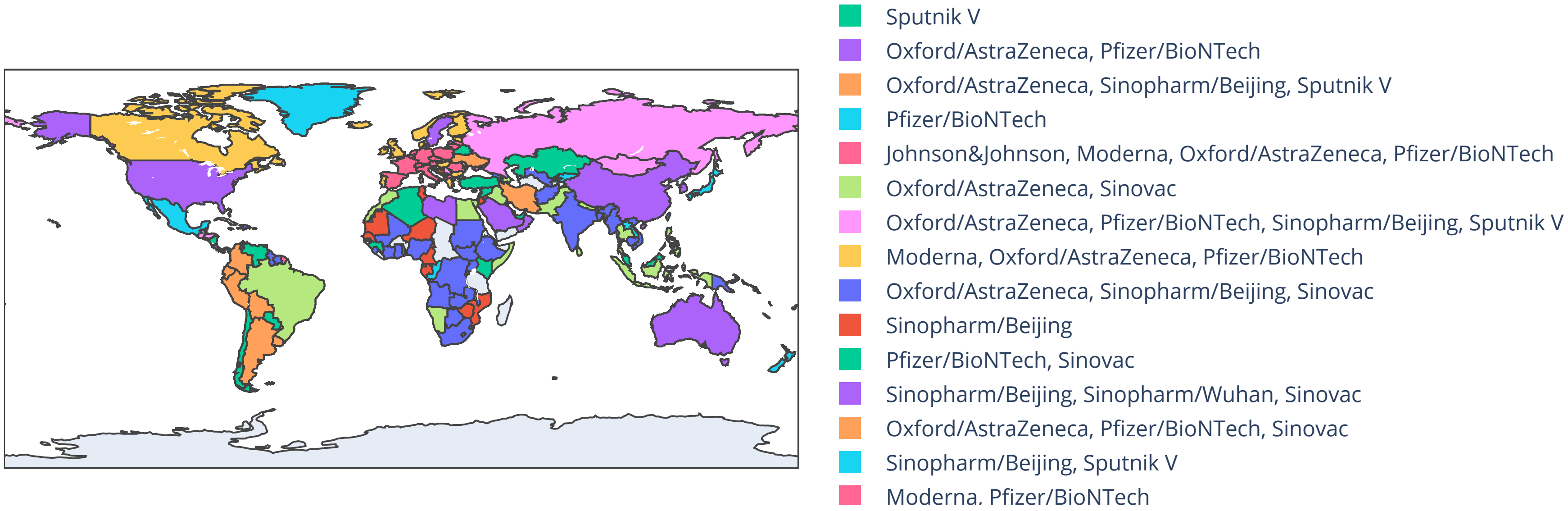
```
Oxford/AstraZeneca:>>{'Democratic Republic of Congo', 'Montserrat', 'Timor', 'Gambia', 'South Sudan', 'Fiji', 'Sierra
Leone', 'Antigua and Barbuda', 'Suriname', 'Bangladesh', 'Malawi', 'Lesotho', 'Saint Vincent and the Grenadines', 'Ba
hamas', 'Cape Verde', 'Samoa', 'Sudan', 'Botswana', 'Grenada', 'Djibouti', "Cote d'Ivoire", 'Falkland Islands', 'Ghan
a', 'Guyana', 'Mali', 'Mauritius', 'Saint Helena', 'Togo', 'Trinidad and Tobago', 'Papua New Guinea', 'Taiwan', 'Sain
t Kitts and Nevis', 'Uzbekistan', 'Belize', 'Vietnam', 'Sao Tome and Principe', 'Brunei', 'Bhutan', 'Nigeria', 'Domin
ica', 'Afghanistan', 'Jamaica', 'Georgia', 'Myanmar', 'Eswatini', 'Solomon Islands', 'Tonga', 'Saint Lucia', 'Nauru',
'Ethiopia', 'Angola', 'Zambia', 'Barbados', 'Uganda', 'Anguilla', 'Kosovo'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Albania', 'Bosnia and Herzegovina'}
Sputnik V:>>{'Kazakhstan', 'Syria', 'Algeria', 'Guinea', 'Belarus', 'Armenia', 'Venezuela', 'Paraguay'}
Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Cayman Islands', 'Costa Rica', 'Panama', 'Slovenia', 'Guernsey', 'South Kore
a', 'Isle of Man', 'Oman', 'Jersey', 'Saudi Arabia', 'Sweden', 'Australia', 'Andorra'}
Oxford/AstraZeneca, Sinopharm/Beijing, Sputnik V:>>{'Argentina', 'Iran', 'Bolivia'}
Pfizer/BioNTech:>>{'Bermuda', 'New Zealand', 'Greenland', 'Turks and Caicos Islands', 'Aruba', 'Slovakia', 'Cyprus',
'Japan', 'Kuwait', 'Qatar', 'Monaco', 'Gibraltar'}
Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Italy', 'Poland', 'Romania', 'Spain', 'Belgium', 'C
zechia', 'France', 'Germany', 'Netherlands', 'Austria', 'Lithuania', 'Latvia'}
Oxford/AstraZeneca, Sinovac:>>{'Thailand', 'Indonesia', 'Azerbaijan', 'Brazil', 'Philippines'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Serbia', 'Bahrain', 'Lebanon', 'Mongolia'}
Moderna, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Portugal', 'Malta', 'Estonia', 'Canada', 'Rwanda', 'Finland', 'Bulga
ria', 'Luxembourg', 'Greece', 'Iceland', 'Croatia', 'Norway', 'Denmark', 'Palestine', 'Ireland', 'United Kingdom'}
Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac:>>{'Cambodia', 'Dominican Republic'}
Sinopharm/Beijing:>>{'Zimbabwe', 'Senegal', 'Equatorial Guinea', 'Mozambique', 'Cameroon', 'Gabon', 'Mauritania', 'Ni
ger'}
Pfizer/BioNTech, Sinovac:>>{'Hong Kong', 'Chile', 'Malaysia', 'Turkey'}
Sinopharm/Beijing, Sinopharm/Wuhan, Sinovac:>>{'China'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Ukraine', 'El Salvador', 'Ecuador', 'Northern Cyprus', 'Uruguay', 'C
olombia'}
Sinopharm/Beijing, Sputnik V:>>{'Laos', 'Montenegro', 'Congo', 'Kyrgyzstan'}
Moderna, Pfizer/BioNTech:>>{'Curacao', 'Israel', 'Faeroe Islands', 'Singapore', 'Switzerland', 'Liechtenstein'}
Oxford/AstraZeneca, Sinopharm/Beijing:>>{'Nepal', 'Egypt', 'Morocco', 'Sri Lanka', 'Somalia', 'Namibia', 'Seychelle
s', 'Iraq'}
Moderna, Oxford/AstraZeneca:>>{'Guatemala', 'Honduras'}
Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Hungary'}
Covaxin, Oxford/AstraZeneca:>>{'India'}
Pfizer/BioNTech, Sinopharm/Beijing:>>{'Jordan', 'Macao'}
Oxford/AstraZeneca, Sputnik V:>>{'Kenya', 'Nicaragua'}
Oxford/AstraZeneca, Sinovac, Sputnik V:>>{'Libya'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Moldova', 'Maldives', 'Peru'}
CanSino, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Mexico'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V:>>{'North Macedonia'}
CanSino, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Pakistan'}
EpiVacCorona, Sputnik V:>>{'Russia'}
Pfizer/BioNTech, Sputnik V:>>{'San Marino'}
Johnson&Johnson:>>{'South Africa'}
Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Tunisia'}
Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinopharm/Wuhan, Sputnik V:>>{'United Arab Emirates'}
Johnson&Johnson, Moderna, Pfizer/BioNTech:>>{'United States'}
```

Now let’s visualize this data to have a look at what combination of vaccines every country is using:

In [11]:

```
import plotly.express as px
import plotly.offline as py

vaccine_map = px.choropleth(data, locations = 'iso_code', color = 'vaccines')
vaccine_map.update_layout(height = 300, margin = {'r':0, 't':0, 'l':0, 'b':0})
vaccine_map.show()
```


🟩 Sputnik V
🟪 Oxford/AstraZeneca, Pfizer/BioNTech
🟧 Oxford/AstraZeneca, Sinopharm/Beijing, Sputnik V
🟦 Pfizer/BioNTech
🟥 Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech
🟩 Oxford/AstraZeneca, Sinovac
🟪 Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V
🟨 Moderna, Oxford/AstraZeneca, Pfizer/BioNTech
🟦 Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac
🟥 Sinopharm/Beijing
🟩 Pfizer/BioNTech, Sinovac
🟪 Sinopharm/Beijing, Sinopharm/Wuhan, Sinovac
🟧 Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac
🟦 Sinopharm/Beijing, Sputnik V
🟥 Moderna. Pfizer/BioNTech

In [ ]: