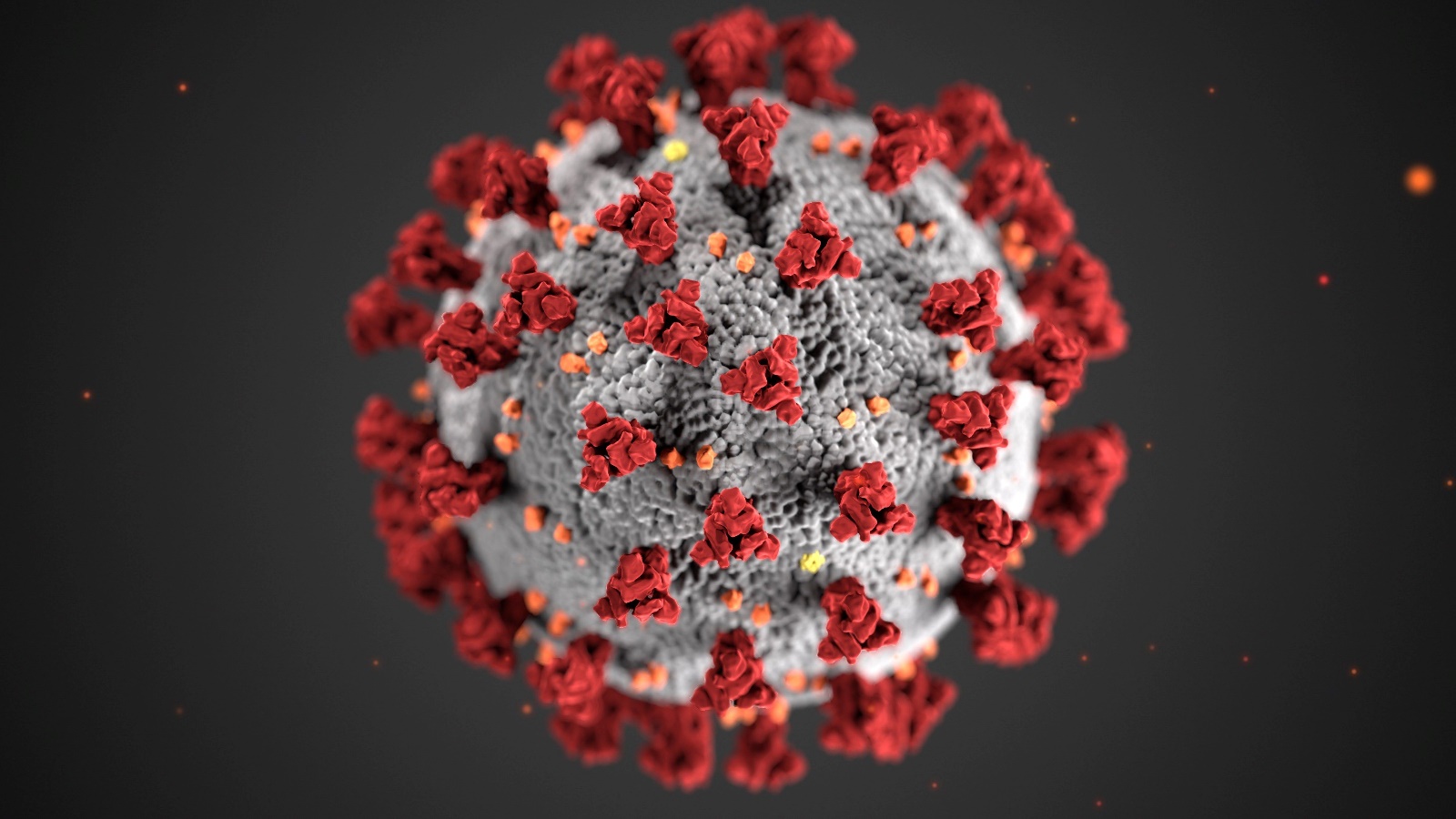
**COVID Vaccines Analysis**

**Phase 1 Submission Document.**

**Project:** COVID Vaccines Analysis

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**Introduction:**

* The "COVID Vaccines Analysis" project is a comprehensive exploration of critical aspects related to COVID-19 vaccines. This project delves into the data surrounding vaccine distribution, administration, and the occurrence of adverse effects, aiming to provide insights that contribute to informed decision-making and public health strategies.
* Our analysis encompasses a wide range of methodologies, from data mining and machine learning techniques to statistical modelling and trend analysis. By leveraging advanced data analytics, we seek to uncover hidden patterns, identify areas of concern, and make meaningful predictions regarding the trajectory of the pandemic and the success of vaccination efforts.

**Content for Project Phase 1:**

* Exploring advanced machine learning techniques like clustering and time series forecasting can be instrumental in uncovering hidden patterns in vaccine distribution and adverse effects data. Here's a more detailed explanation of how you can utilize these techniques.

**Dataset link:**

**Dataset Link:**[**https://www.kaggle.com/datasets/gpreda/covid-world-vaccination-progress**](https://www.kaggle.com/datasets/gpreda/covid-world-vaccination-progress)

**Program**

IN[1]:

import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns

import os

for dirname, \_, filenames **in** os.walk('/kaggle/input'):

for filename **in** filenames:

print(os.path.join(dirname, filename))

/opt/conda/lib/python3.10/site-packages/scipy/\_\_init\_\_.py:146: UserWarning: A NumPy version >=1.16.5 and <1.23.0 is required for this version of SciPy (detected version 1.23.5

warnings.warn(f"A NumPy version >={np\_minversion} and <{np\_maxversion}"

/kaggle/input/covid-world-vaccination-progress/country\_vaccinations\_by\_manufacturer.csv

/kaggle/input/covid-world-vaccination-progress/country\_vaccinations.csv

In [2]:

data = pd.read\_csv("/kaggle/input/covid-world-vaccination-progress/country\_vaccinations.csv")

data.head()

Out[2]:

|  | country | iso\_code | date | total\_vaccinations | people\_vaccinated | people\_fully\_vaccinated | daily\_vaccinations\_raw | daily\_vaccinations | total\_vaccinations\_per\_hundred | people\_vaccinated\_per\_hundred | people\_fully\_vaccinated\_per\_hundred | daily\_vaccinations\_per\_million | vaccines | source\_name | source\_website |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | Afghanistan | AFG | 2021-02-22 | 0.0 | 0.0 | NaN | NaN | NaN | 0.0 | 0.0 | NaN | NaN | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | World Health Organization | https://covid19.who.int/ |
| 1 | Afghanistan | AFG | 2021-02-23 | NaN | NaN | NaN | NaN | 1367.0 | NaN | NaN | NaN | 34.0 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | World Health Organization | https://covid19.who.int/ |
| 2 | Afghanistan | AFG | 2021-02-24 | NaN | NaN | NaN | NaN | 1367.0 | NaN | NaN | NaN | 34.0 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | World Health Organization | https://covid19.who.int/ |
| 3 | Afghanistan | AFG | 2021-02-25 | NaN | NaN | NaN | NaN | 1367.0 | NaN | NaN | NaN | 34.0 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | World Health Organization | https://covid19.who.int/ |
| 4 | Afghanistan | AFG | 2021-02-26 | NaN | NaN | NaN | NaN | 1367.0 | NaN | NaN | NaN | 34.0 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | World Health Organization | https://covid19.who.int/ |

In [3]:

data.describe()

Out[3]:

|  | total\_vaccinations | people\_vaccinated | people\_fully\_vaccinated | daily\_vaccinations\_raw | daily\_vaccinations | total\_vaccinations\_per\_hundred | people\_vaccinated\_per\_hundred | people\_fully\_vaccinated\_per\_hundred | daily\_vaccinations\_per\_million |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| count | 4.360700e+04 | 4.129400e+04 | 3.880200e+04 | 3.536200e+04 | 8.621300e+04 | 43607.000000 | 41294.000000 | 38802.000000 | 86213.000000 |
| mean | 4.592964e+07 | 1.770508e+07 | 1.413830e+07 | 2.705996e+05 | 1.313055e+05 | 80.188543 | 40.927317 | 35.523243 | 3257.049157 |
| std | 2.246004e+08 | 7.078731e+07 | 5.713920e+07 | 1.212427e+06 | 7.682388e+05 | 67.913577 | 29.290759 | 28.376252 | 3934.312440 |
| min | 0.000000e+00 | 0.000000e+00 | 1.000000e+00 | 0.000000e+00 | 0.000000e+00 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 25% | 5.264100e+05 | 3.494642e+05 | 2.439622e+05 | 4.668000e+03 | 9.000000e+02 | 16.050000 | 11.370000 | 7.020000 | 636.000000 |
| 50% | 3.590096e+06 | 2.187310e+06 | 1.722140e+06 | 2.530900e+04 | 7.343000e+03 | 67.520000 | 41.435000 | 31.750000 | 2050.000000 |
| 75% | 1.701230e+07 | 9.152520e+06 | 7.559870e+06 | 1.234925e+05 | 4.409800e+04 | 132.735000 | 67.910000 | 62.080000 | 4682.000000 |
| max | 3.263129e+09 | 1.275541e+09 | 1.240777e+09 | 2.474100e+07 | 2.242429e+07 | 345.370000 | 124.760000 | 122.370000 | 117497.000000 |

In [4]:

pd.to\_datetime(data.date)

data.country.value\_counts()

Out[4]:

Norway 482

Latvia 480

Denmark 476

United States 471

Russia 470

...

Bonaire Sint Eustatius and Saba 146

Tokelau 114

Saint Helena 92

Pitcairn 85

Falkland Islands 67

Name: country, Length: 223, dtype: int64

In [5]:

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

data.country.value\_counts()

Out[5]:

Norway 482

Latvia 480

Denmark 476

United States 471

Canada 470

...

Bonaire Sint Eustatius and Saba 146

Tokelau 114

Saint Helena 92

Pitcairn 85

Falkland Islands 67

Name: country, Length: 219, dtype: int64

In [6]:

data.vaccines.value\_counts()

Out[6]:

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech 7608

Oxford/AstraZeneca 6022

Oxford/AstraZeneca, Pfizer/BioNTech 4629

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech 4491

Johnson&Johnson, Moderna, Novavax, Oxford/AstraZeneca, Pfizer/BioNTech 3564

...

Johnson&Johnson, Oxford/AstraZeneca, Sinovac 312

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V 311

Johnson&Johnson, Moderna 251

Johnson&Johnson, Pfizer/BioNTech, Sinopharm/Beijing 228

EpiVacCorona, Oxford/AstraZeneca, QazVac, Sinopharm/Beijing, Sputnik V, ZF2001 190

Name: vaccines, Length: 84, dtype: int64

In [7]:

df = data[["vaccines", "country"]]

df.head()

Out[7]:

|  | vaccines | country |
| --- | --- | --- |
| 0 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | Afghanistan |
| 1 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | Afghanistan |
| 2 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | Afghanistan |
| 3 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | Afghanistan |
| 4 | Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi... | Afghanistan |

In [8]:

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**}**")

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Cameroon', 'Afghanistan', 'Belize', 'Namibia', 'Trinidad and Tobago'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Oman', 'Bosnia and Herzegovina', 'Albania', 'Azerbaijan'}

Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Algeria', 'Zimbabwe'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Guernsey', 'United Kingdom', 'Fiji', 'Sweden', 'Australia', 'Jersey', 'Sint Maarten (Dutch part)', 'Finland', 'Andorra', 'Japan', 'Isle of Man'}

Oxford/AstraZeneca:>>{'Montserrat', 'Kiribati', 'Saint Helena', 'Saint Vincent and the Grenadines', 'Liberia', 'Falkland Islands', 'Solomon Islands', 'Tuvalu', 'Vanuatu', 'Democratic Republic of Congo', 'Pitcairn', 'Mali', 'Papua New Guinea', 'Nigeria', 'Samoa', 'Nauru', 'Togo', 'Angola', 'Tonga', 'Sao Tome and Principe'}

Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Anguilla', 'Saudi Arabia', 'Gibraltar', 'Saint Lucia', 'Cayman Islands', 'New Zealand', 'Saint Kitts and Nevis', 'Panama', 'Bermuda', 'Costa Rica', 'Kosovo'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V:>>{'Antigua and Barbuda'}

CanSino, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Argentina'}

Moderna, Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Armenia'}

Pfizer/BioNTech:>>{'Monaco', 'Tokelau', 'Cook Islands', 'New Caledonia', 'Turks and Caicos Islands', 'Niue', 'Aruba'}

Johnson&Johnson, Moderna, Novavax, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Czechia', 'Slovenia', 'Netherlands', 'Germany', 'Austria', 'South Korea', 'Lithuania', 'Italy'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Bahamas', 'Eswatini', 'Grenada'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik Light, Sputnik V:>>{'Bahrain'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Bangladesh'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Maldives', 'Peru', 'Suriname', 'Barbados', 'Dominica'}

Sinopharm/Beijing, Sputnik V:>>{'Belarus', 'Kyrgyzstan'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Cyprus', 'Portugal', 'Iceland', 'Malta', 'Belgium', 'Croatia', 'Jamaica', 'Luxembourg', 'Poland', 'France', 'Greece', 'Spain', 'Romania', 'Bulgaria', 'Estonia', 'Ireland', 'Canada'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Benin', 'Brazil'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Cape Verde', 'Bhutan'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Moldova', "Cote d'Ivoire", 'Morocco', 'Bolivia'}

Moderna, Pfizer/BioNTech:>>{'Faeroe Islands', 'Norway', 'Bonaire Sint Eustatius and Saba', 'Curacao', 'Qatar', 'Israel'}

Covaxin, Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Botswana'}

Johnson&Johnson, Oxford/AstraZeneca:>>{'British Virgin Islands', 'South Sudan', 'Malawi'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Nepal', 'Brunei', 'Kenya', 'Kuwait'}

Johnson&Johnson, Oxford/AstraZeneca, Sinopharm/Beijing:>>{'Gambia', 'Mozambique', 'Madagascar', 'Senegal', 'Lesotho', 'Zambia', 'Burkina Faso'}

Sinopharm/Beijing:>>{'Equatorial Guinea', 'Burundi', 'Chad'}

Johnson&Johnson, Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac:>>{'Somalia', 'Cambodia'}

Covaxin, Oxford/AstraZeneca:>>{'Central African Republic'}

CanSino, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Chile', 'Ecuador'}

CanSino, Sinopharm/Beijing, Sinopharm/Wuhan, Sinovac, ZF2001:>>{'China'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Uganda', 'Ukraine', 'Colombia'}

Covaxin, Oxford/AstraZeneca, Sinopharm/Beijing:>>{'Mauritius', 'Comoros'}

Moderna, Oxford/AstraZeneca, Sinopharm/Beijing, Sputnik V:>>{'Congo'}

Abdala, Soberana Plus, Soberana02:>>{'Cuba'}

Johnson&Johnson, Moderna, Pfizer/BioNTech:>>{'United States', 'Liechtenstein', 'Denmark', 'Switzerland'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Egypt', 'Djibouti', 'Guinea'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Dominican Republic', 'Georgia', 'El Salvador'}

Covaxin, Johnson&Johnson, Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac:>>{'Ethiopia'}

Johnson&Johnson, Pfizer/BioNTech:>>{'South Africa', 'French Polynesia'}

Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Gabon'}

Oxford/AstraZeneca, Sputnik V:>>{'Ghana'}

Moderna:>>{'Greenland', 'Wallis and Futuna'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V:>>{'Guatemala'}

Oxford/AstraZeneca, Sinopharm/Beijing:>>{'Niger', 'Myanmar', 'Mauritania', 'Sierra Leone', 'Guinea-Bissau'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Sri Lanka', 'Guyana'}

Johnson&Johnson, Moderna:>>{'Haiti'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V:>>{'Honduras'}

Pfizer/BioNTech, Sinovac:>>{'Hong Kong'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Hungary', 'Jordan'}

Covaxin, Oxford/AstraZeneca, Sputnik V:>>{'India'}

Johnson&Johnson, Moderna, Novavax, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Indonesia'}

COVIran Barekat, Covaxin, FAKHRAVAC, Oxford/AstraZeneca, Razi Cov Pars, Sinopharm/Beijing, Soberana02, SpikoGen, Sputnik V:>>{'Iran'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Lebanon', 'Iraq', 'Montenegro', 'Mongolia', 'Serbia'}

QazVac, Sinopharm/Beijing, Sputnik V:>>{'Kazakhstan'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik Light, Sputnik V:>>{'Laos'}

Johnson&Johnson, Moderna, Novavax, Pfizer/BioNTech:>>{'Latvia'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'North Macedonia', 'Libya'}

Pfizer/BioNTech, Sinopharm/Beijing:>>{'Macao'}

CanSino, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Malaysia'}

CanSino, Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Mexico'}

Abdala, Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Soberana02, Sputnik Light, Sputnik V:>>{'Nicaragua'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac:>>{'Northern Cyprus', 'Timor', 'Uruguay'}

CanSino, Covaxin, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Pakistan'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik Light, Sputnik V:>>{'Palestine', 'Philippines'}

Covaxin, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Paraguay'}

EpiVacCorona, Sputnik V:>>{'Russia'}

Johnson&Johnson, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V:>>{'Tunisia', 'Rwanda'}

Pfizer/BioNTech, Sputnik V:>>{'San Marino'}

Oxford/AstraZeneca, Sinopharm/Beijing, Sputnik V:>>{'Seychelles'}

Moderna, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Singapore'}

Johnson&Johnson, Moderna, Novavax, Oxford/AstraZeneca, Pfizer/BioNTech, Sputnik V:>>{'Slovakia'}

Johnson&Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Sudan'}

Johnson&Johnson, Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac, Sputnik Light, Sputnik V:>>{'Syria'}

Medigen, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech:>>{'Taiwan'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik V:>>{'Tajikistan'}

Johnson&Johnson, Pfizer/BioNTech, Sinopharm/Beijing:>>{'Tanzania'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac:>>{'Thailand'}

Pfizer/BioNTech, Sinovac, Turkovac:>>{'Turkey'}

EpiVacCorona, Oxford/AstraZeneca, QazVac, Sinopharm/Beijing, Sputnik V, ZF2001:>>{'Turkmenistan'}

Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinopharm/Wuhan, Sputnik V:>>{'United Arab Emirates'}

Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinovac, Sputnik Light, Sputnik V, ZF2001:>>{'Uzbekistan'}

Abdala, Sinopharm/Beijing, Sinovac, Soberana02, Sputnik Light, Sputnik V:>>{'Venezuela'}

Abdala, Moderna, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sputnik V:>>{'Vietnam'}

Johnson&Johnson, Oxford/AstraZeneca, Sinovac:>>{'Yemen'}

In [9]:

linkcode

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()