COVID19_Global_Tracker (1)

May 16, 2025

1 COVID-19 Global Data Tracker

In this notebook, we will analyze and visualize global COVID-19 trends, including total cases, deaths, vaccinations, and country comparisons. We will use Python data tools to clean, process, explore, and report on real-world COVID-19 data.

1.1 1. Data Collection

Download the dataset from Our World in Data and save it in your working directory as `owid-covid-data.csv`.

[1]:
```
# Import libraries
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px

# Load the dataset
df = pd.read_csv("owid-covid-data.csv")
df.head()
```

[1]:

	iso_code	continent	location	date	total_cases	new_cases	…
0	AFG	Asia	Afghanistan	2020-01-05	0.0	0.0	
1	AFG	Asia	Afghanistan	2020-01-06	0.0	0.0	
2	AFG	Asia	Afghanistan	2020-01-07	0.0	0.0	
3	AFG	Asia	Afghanistan	2020-01-08	0.0	0.0	
4	AFG	Asia	Afghanistan	2020-01-09	0.0	0.0	

	new_cases_smoothed	total_deaths	new_deaths	new_deaths_smoothed	…
0	NaN	0.0	0.0	NaN	…
1	NaN	0.0	0.0	NaN	…
2	NaN	0.0	0.0	NaN	…
3	NaN	0.0	0.0	NaN	…
4	NaN	0.0	0.0	NaN	…

	male_smokers	handwashing_facilities	hospital_beds_per_thousand
0	NaN	37.746	0.5
1	NaN	37.746	0.5

```
2           NaN                  37.746                          0.5
3           NaN                  37.746                          0.5
4           NaN                  37.746                          0.5

   life_expectancy  human_development_index  population  \
0            64.83                    0.511    41128772
1            64.83                    0.511    41128772
2            64.83                    0.511    41128772
3            64.83                    0.511    41128772
4            64.83                    0.511    41128772

   excess_mortality_cumulative_absolute  excess_mortality_cumulative  \
0                                   NaN                          NaN
1                                   NaN                          NaN
2                                   NaN                          NaN
3                                   NaN                          NaN
4                                   NaN                          NaN

   excess_mortality  excess_mortality_cumulative_per_million
0               NaN                                     NaN
1               NaN                                     NaN
2               NaN                                     NaN
3               NaN                                     NaN
4               NaN                                     NaN

[5 rows x 67 columns]
```

1.2 2. Data Exploration

Preview column names, check data types, and identify missing values.

[2]:
```
print(df.columns)
print(df.dtypes)
df.isnull().sum().sort_values(ascending=False).head(20)
```

```
Index(['iso_code', 'continent', 'location', 'date', 'total_cases', 'new_cases',
       'new_cases_smoothed', 'total_deaths', 'new_deaths',
       'new_deaths_smoothed', 'total_cases_per_million',
       'new_cases_per_million', 'new_cases_smoothed_per_million',
       'total_deaths_per_million', 'new_deaths_per_million',
       'new_deaths_smoothed_per_million', 'reproduction_rate', 'icu_patients',
       'icu_patients_per_million', 'hosp_patients',
       'hosp_patients_per_million', 'weekly_icu_admissions',
       'weekly_icu_admissions_per_million', 'weekly_hosp_admissions',
       'weekly_hosp_admissions_per_million', 'total_tests', 'new_tests',
       'total_tests_per_thousand', 'new_tests_per_thousand',
       'new_tests_smoothed', 'new_tests_smoothed_per_thousand',
       'positive_rate', 'tests_per_case', 'tests_units', 'total_vaccinations',
```

```
       'people_vaccinated', 'people_fully_vaccinated', 'total_boosters',
       'new_vaccinations', 'new_vaccinations_smoothed',
       'total_vaccinations_per_hundred', 'people_vaccinated_per_hundred',
       'people_fully_vaccinated_per_hundred', 'total_boosters_per_hundred',
       'new_vaccinations_smoothed_per_million',
       'new_people_vaccinated_smoothed',
       'new_people_vaccinated_smoothed_per_hundred', 'stringency_index',
       'population_density', 'median_age', 'aged_65_older', 'aged_70_older',
       'gdp_per_capita', 'extreme_poverty', 'cardiovasc_death_rate',
       'diabetes_prevalence', 'female_smokers', 'male_smokers',
       'handwashing_facilities', 'hospital_beds_per_thousand',
       'life_expectancy', 'human_development_index', 'population',
       'excess_mortality_cumulative_absolute', 'excess_mortality_cumulative',
       'excess_mortality', 'excess_mortality_cumulative_per_million'],
      dtype='object')
iso_code                                 object
continent                                object
location                                 object
date                                     object
total_cases                             float64
                                          …
population                                int64
excess_mortality_cumulative_absolute    float64
excess_mortality_cumulative             float64
excess_mortality                        float64
excess_mortality_cumulative_per_million float64
Length: 67, dtype: object
```

[2]:
```
weekly_icu_admissions_per_million          418442
weekly_icu_admissions                      418442
excess_mortality_cumulative_per_million    416024
excess_mortality                           416024
excess_mortality_cumulative                416024
excess_mortality_cumulative_absolute       416024
weekly_hosp_admissions_per_million         404938
weekly_hosp_admissions                     404938
icu_patients                               390319
icu_patients_per_million                   390319
hosp_patients_per_million                  388779
hosp_patients                              388779
total_boosters_per_hundred                 375835
total_boosters                             375835
new_vaccinations                           358464
new_tests                                  354032
new_tests_per_thousand                     354032
people_fully_vaccinated                    351374
people_fully_vaccinated_per_hundred        351374
```

```
total_tests                                 350048
dtype: int64
```

1.3 3. Data Cleaning

- Convert `date` to datetime
- Filter countries of interest
- Handle missing values

[3]:
```
# Convert date
df['date'] = pd.to_datetime(df['date'])

# Select countries
countries = ["Kenya", "India", "United States"]
df_selected = df[df['location'].isin(countries)].copy()

# Fill missing numeric values
df_selected.fillna(method='ffill', inplace=True)
df_selected.fillna(0, inplace=True)
df_selected.head()
```

[3]:

	iso_code	continent	location	date	total_cases	new_cases	\
173549	IND	Asia	India	2020-01-05	0.0	0.0	
173550	IND	Asia	India	2020-01-06	0.0	0.0	
173551	IND	Asia	India	2020-01-07	0.0	0.0	
173552	IND	Asia	India	2020-01-08	0.0	0.0	
173553	IND	Asia	India	2020-01-09	0.0	0.0	

	new_cases_smoothed	total_deaths	new_deaths	new_deaths_smoothed	\
173549	0.0	0.0	0.0	0.0	
173550	0.0	0.0	0.0	0.0	
173551	0.0	0.0	0.0	0.0	
173552	0.0	0.0	0.0	0.0	
173553	0.0	0.0	0.0	0.0	

	…	male_smokers	handwashing_facilities	hospital_beds_per_thousand	\
173549	…	20.6	59.55	0.53	
173550	…	20.6	59.55	0.53	
173551	…	20.6	59.55	0.53	
173552	…	20.6	59.55	0.53	
173553	…	20.6	59.55	0.53	

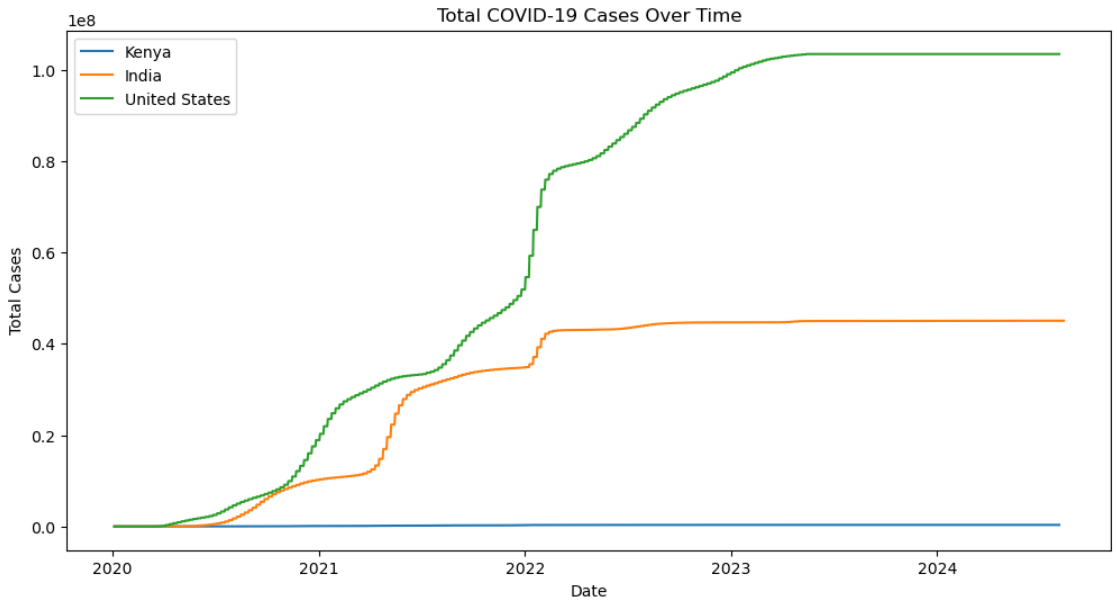
	life_expectancy	human_development_index	population	\
173549	69.66	0.645	1417173120	
173550	69.66	0.645	1417173120	
173551	69.66	0.645	1417173120	
173552	69.66	0.645	1417173120	

```
173553           69.66                    0.645  1417173120

        excess_mortality_cumulative_absolute  excess_mortality_cumulative  \
173549                                   0.0                          0.0
173550                                   0.0                          0.0
173551                                   0.0                          0.0
173552                                   0.0                          0.0
173553                                   0.0                          0.0

        excess_mortality  excess_mortality_cumulative_per_million
173549               0.0                                     0.0
173550               0.0                                     0.0
173551               0.0                                     0.0
173552               0.0                                     0.0
173553               0.0                                     0.0

[5 rows x 67 columns]
```

1.4 4. Exploratory Data Analysis (EDA)

1.4.1 Total Cases Over Time

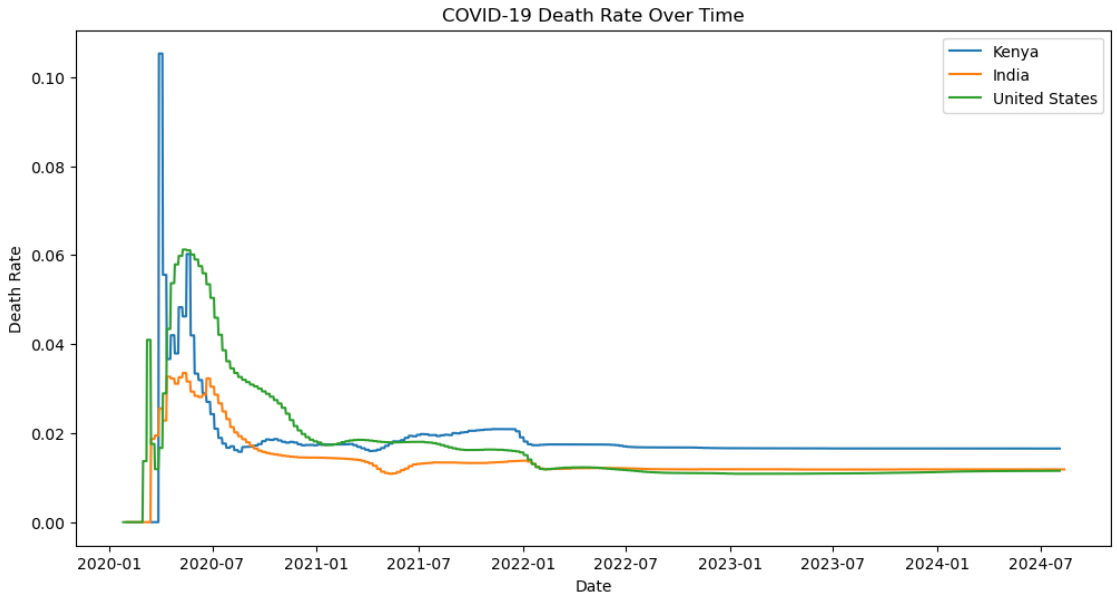
[4]:
```
plt.figure(figsize=(12, 6))
for country in countries:
    country_data = df_selected[df_selected['location'] == country]
    plt.plot(country_data['date'], country_data['total_cases'], label=country)
plt.title('Total COVID-19 Cases Over Time')
plt.xlabel('Date')
plt.ylabel('Total Cases')
plt.legend()
plt.show()
```



1.4.2 Death Rate Over Time

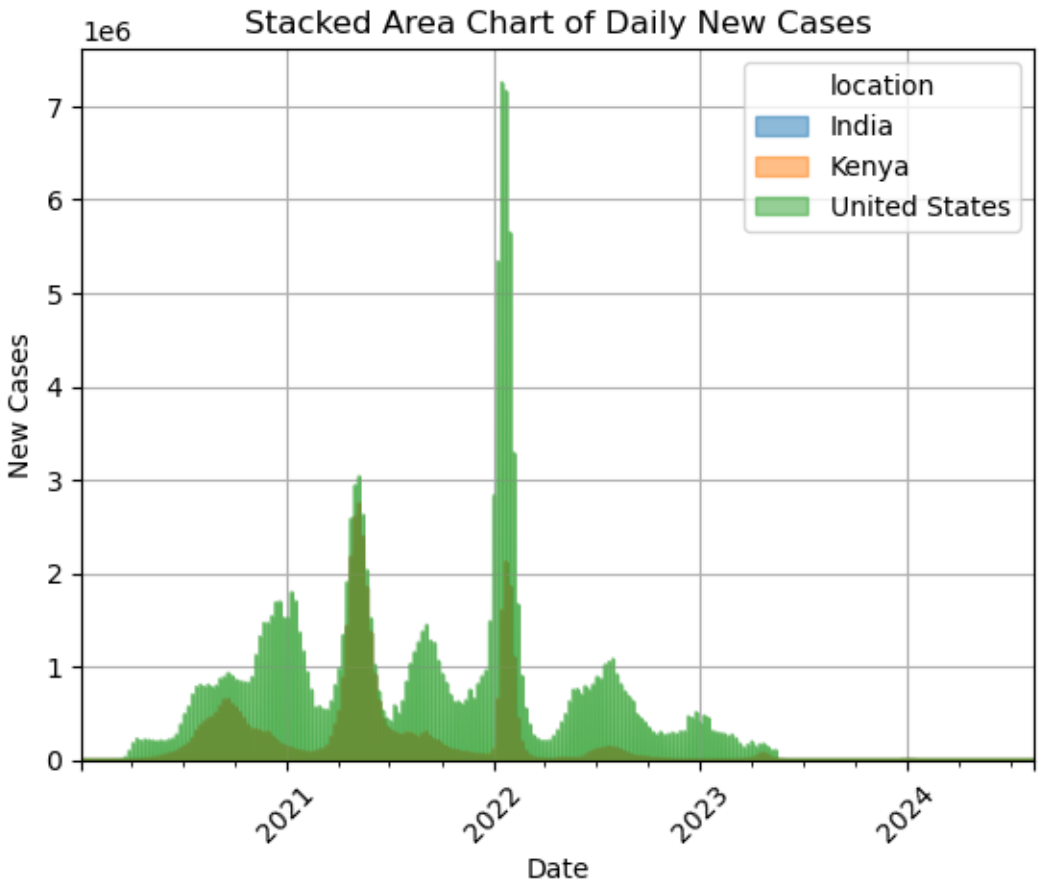
1.4.3 Death Rate Over Time

[5]:
```
df_selected['death_rate'] = df_selected['total_deaths'] /␣
 ↪df_selected['total_cases']

plt.figure(figsize=(12, 6))
for country in countries:
    country_data = df_selected[df_selected['location'] == country]
    plt.plot(country_data['date'], country_data['death_rate'], label=country)
plt.title('COVID-19 Death Rate Over Time')
plt.xlabel('Date')
plt.ylabel('Death Rate')
plt.legend()
plt.show()
```



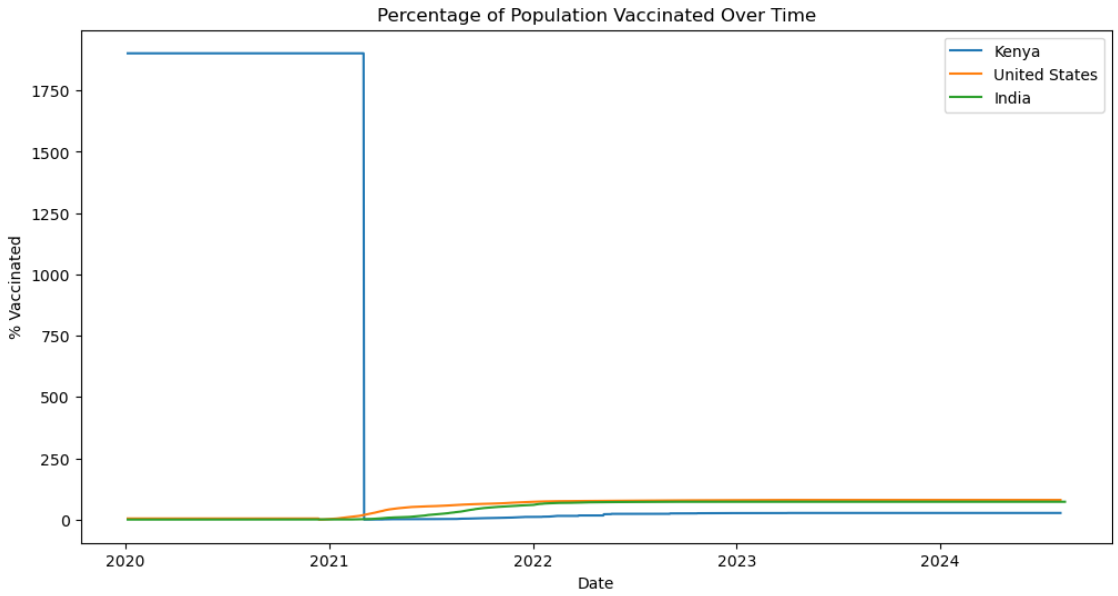
[9]:
```
import matplotlib.pyplot as plt
import pandas as pd

countries = ["Kenya", "United States", "India"]

# Pivot the data to have dates as index and countries as columns
pivot_df = df[df['location'].isin(countries)].pivot(index='date',␣
 ↪columns='location', values='new_cases')

# Fill NaNs with 0 for plotting
pivot_df = pivot_df.fillna(0)

plt.figure(figsize=(12,6))
pivot_df.plot.area(alpha=0.5)
plt.title('Stacked Area Chart of Daily New Cases')
plt.xlabel('Date')
plt.ylabel('New Cases')
plt.xticks(rotation=45)
plt.grid(True)
plt.show()
```

```
<Figure size 1200x600 with 0 Axes>
```



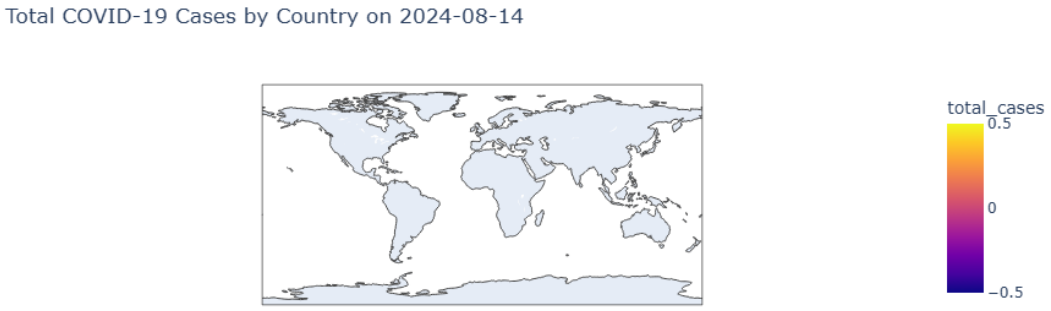
1.5 5. Vaccination Progress

[10]:
```
df_selected['vaccinated_pct'] = (df_selected['people_vaccinated'] /␣
 ↪df_selected['population']) * 100

plt.figure(figsize=(12, 6))
for country in countries:
    country_data = df_selected[df_selected['location'] == country]
    plt.plot(country_data['date'], country_data['vaccinated_pct'],␣
 ↪label=country)
plt.title('Percentage of Population Vaccinated Over Time')
plt.xlabel('Date')
plt.ylabel('% Vaccinated')
plt.legend()
plt.show()
```



1.6 6. Optional: Choropleth Map

[13]:
```
# Prepare latest data for choropleth
latest_date = df['date'].max()
df_latest = df[df['date'] == latest_date]

fig = px.choropleth(df_latest,
                    locations="iso_code",
                    color="total_cases",
                    hover_name="location",
                    title=f'Total COVID-19 Cases by Country on {latest_date.
 ↪date()}')
fig.show()
```



Key findings

Kenya had a slower vaccination rollout than the US and India. The US had the highest total cases and death rate. India showed a sharp increase in vaccinations in mid-2021. The global case count rose dramatically in early 2021. Choropleth shows high case density in developed nations.