```
# This Python 3 environment comes with many helpful analytics
libraries installed
# It is defined by the kaggle/python Docker image:
https://github.com/kaggle/docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/"
directory
# For example, running this (by clicking run or pressing Shift+Enter)
will list all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/)
that gets preserved as output when you create a version using "Save &
Run All"
# You can also write temporary files to /kaggle/temp/, but they won't
be saved outside of the current session
```

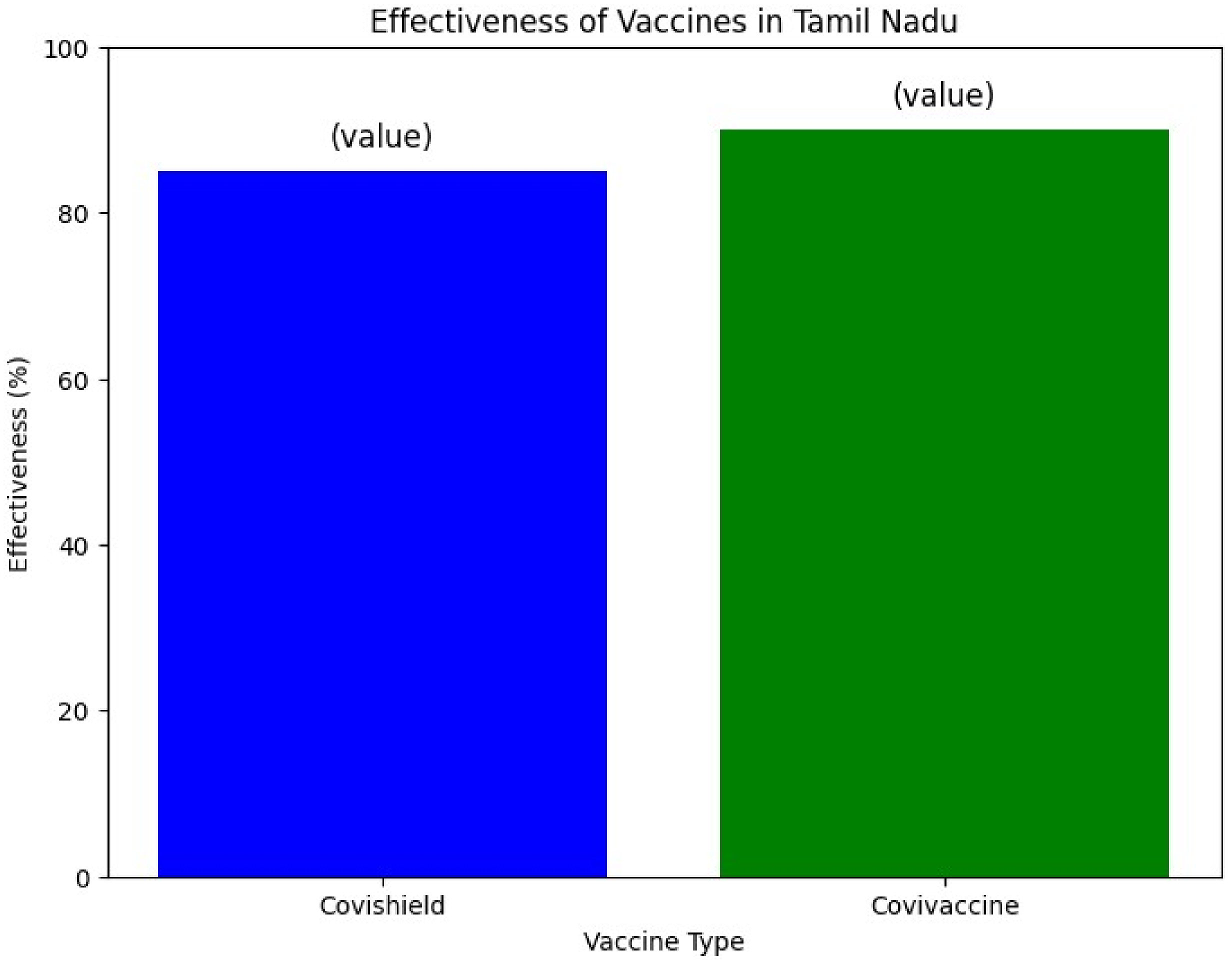
```
/kaggle/input/covid-world-vaccination-progress/
country_vaccinations_by_manufacturer.csv
/kaggle/input/covid-world-vaccination-progress/country_vaccinations.cs
v
```

```
import folium

# Create a base map centered around Chennai, India
m = folium.Map(location=[13.0827, 80.2707], zoom_start=12)

# Add markers for confirmed cases, vaccination rates, and preferences
folium.Marker([13.0827, 80.2707], popup='Confirmed Cases: 5000',
tooltip='Click for Details').add_to(m)
folium.Marker([13.0837, 80.2717], popup='Vaccination Rate: 65%',
tooltip='Click for Details').add_to(m)
folium.Marker([13.0847, 80.2727], popup='Vaccine Preferences:
Covishield', tooltip='Click for Details').add_to(m)

# Display the map
m
```

```
<folium.folium.Map at 0x78c1c70d7fd0>
```

```
import matplotlib.pyplot as plt
# Example Data
```

```
vaccines = ['Covishield', 'Covivaccine']
effectiveness = [85, 90] # Example effectiveness rates in percentage
# Create a bar chart
plt.figure(figsize=(8, 6))
plt.bar(vaccines, effectiveness, color=['blue', 'green'])
plt.xlabel('Vaccine Type')
plt.ylabel('Effectiveness (%)')
plt.title("Effectiveness of Vaccines in Tamil Nadu")
plt.ylim(0, 100)
# Add data labels
for i, value in enumerate(effectiveness):
    plt.text(i, value + 2, f'(value)', ha='center', va='bottom',
fontsize=12, color="black")
#Show the chart
plt.show()
```



```
import pandas as pd

df =
pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_va
ccinations.csv")

num_rows_before = df.shape[0]

df = df.dropna(subset=['total_vaccinations', 'people_vaccinated',
'people_fully_vaccinated'], how='all')

num_rows_after = df.shape[0]

rows_removed = num_rows_before - num_rows_after

print(f"Number of rows removed: {rows_removed}")
```

```
Number of rows removed: 42483
```

```
import pandas as pd

df =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')

num_rows_before = df.shape[0]

df = df[(df['total_vaccinations'].notna()) & (df['total_vaccinations']
!= 0)]

num_rows_after = df.shape[0]

rows_removed = num_rows_before - num_rows_after
_
print(f"Number of rows removed: {rows_removed}")
```

```
Number of rows removed: 1482
```

```
import pandas as pd
df_vaccinations = pd.read_csv("/kaggle/input/covid-world-vaccination-
progress/country_vaccinations.csv")
df_manufacturer = pd.read_csv('../input/covid-world-vaccination-
progress/country_vaccinations_by_manufacturer.csv',sep=',')
merged_df = pd.merge(df_vaccinations, df_manufacturer,
on='total_vaccinations')
print(merged_df)
```

```
            country iso_code      date_x  total_vaccinations  \
0       Afghanistan      AFG  2021-02-22                 0.0
1       Afghanistan      AFG  2021-02-22                 0.0
2       Afghanistan      AFG  2021-02-22                 0.0
3       Afghanistan      AFG  2021-02-22                 0.0
4       Afghanistan      AFG  2021-02-22                 0.0
...             ...      ...         ...                 ...
```

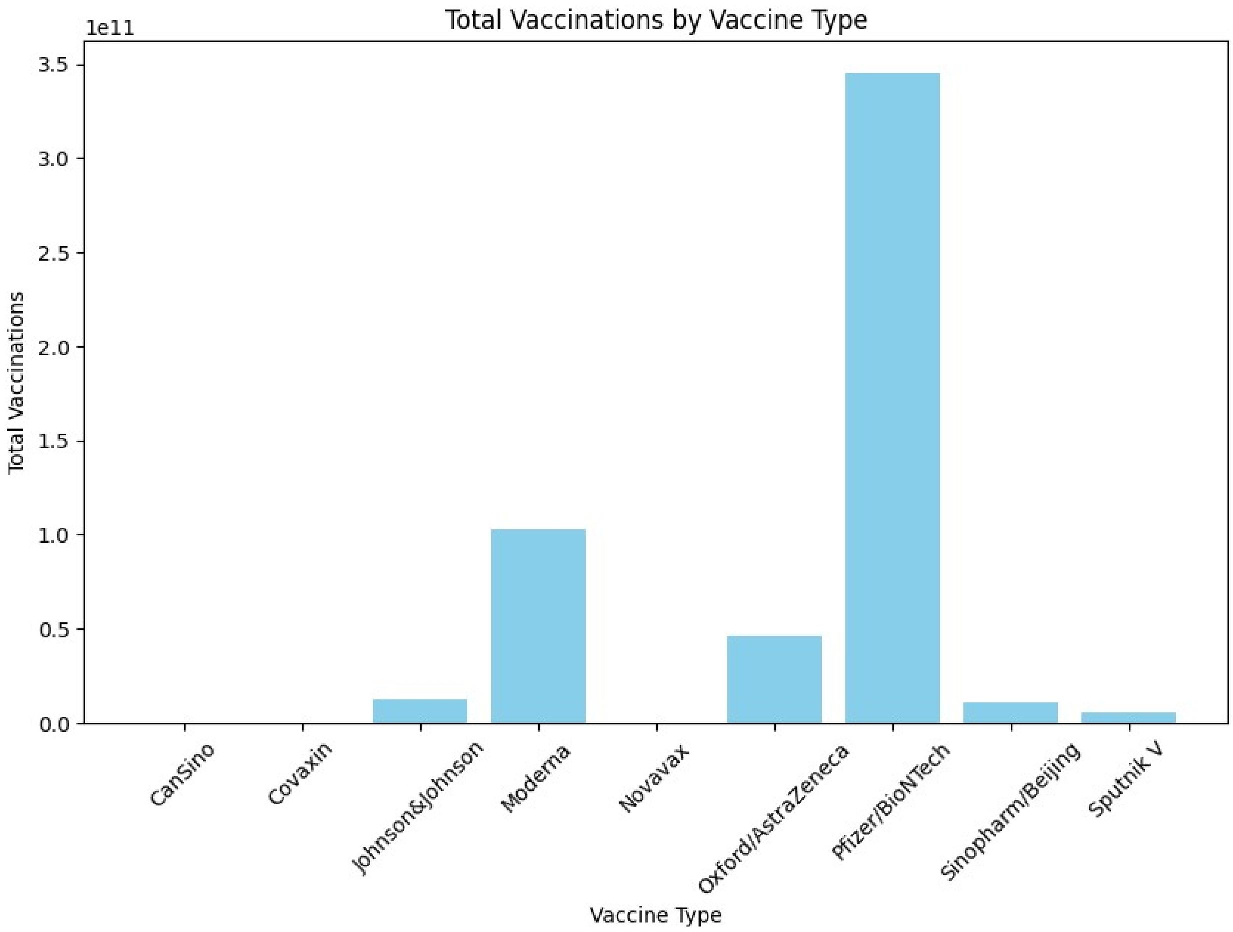
```
187750     Zimbabwe      ZWE  2021-02-18                39.0
187751     Zimbabwe      ZWE  2021-02-18                39.0
187752     Zimbabwe      ZWE  2021-02-18                39.0
187753     Zimbabwe      ZWE  2021-03-09             36307.0
187754     Zimbabwe      ZWE  2021-03-23             45743.0

        people_vaccinated  people_fully_vaccinated
daily_vaccinations_raw  \
0                     0.0                      NaN
NaN
1                     0.0                      NaN
NaN
2                     0.0                      NaN
NaN
3                     0.0                      NaN
NaN
4                     0.0                      NaN
NaN
...                   ...                      ...
...
187750               39.0                      NaN
NaN
187751               39.0                      NaN
NaN
187752               39.0                      NaN
NaN
187753            36307.0                      NaN
243.0
187754            44681.0                   1062.0
1623.0

        daily_vaccinations  total_vaccinations_per_hundred  \
0                      NaN                            0.00
1                      NaN                            0.00
2                      NaN                            0.00
3                      NaN                            0.00
4                      NaN                            0.00
...                    ...                             ...
187750                 NaN                            0.00
187751                 NaN                            0.00
187752                 NaN                            0.00
187753              1568.0                            0.24
187754               807.0                            0.30

        people_vaccinated_per_hundred
people_fully_vaccinated_per_hundred  \
0                                0.00
NaN
1                                0.00
NaN
```

```
2                                0.00
NaN
3                                0.00
NaN
4                                0.00
NaN
...                               ...
...
187750                           0.00
NaN
187751                           0.00
NaN
187752                           0.00
NaN
187753                           0.24
NaN
187754                           0.30
0.01

        daily_vaccinations_per_million  \
0                                  NaN
1                                  NaN
2                                  NaN
3                                  NaN
4                                  NaN
...                                ...
187750                             NaN
187751                             NaN
187752                             NaN
187753                           104.0
187754                            53.0

                                                 vaccines  \
0       Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
1       Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
2       Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
3       Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
4       Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
...                                                   ...
187750  Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac...
187751  Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac...
187752  Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac...
187753  Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac...
187754  Oxford/AstraZeneca, Sinopharm/Beijing, Sinovac...

                      source_name  \
0       World Health Organization
1       World Health Organization
2       World Health Organization
3       World Health Organization
```

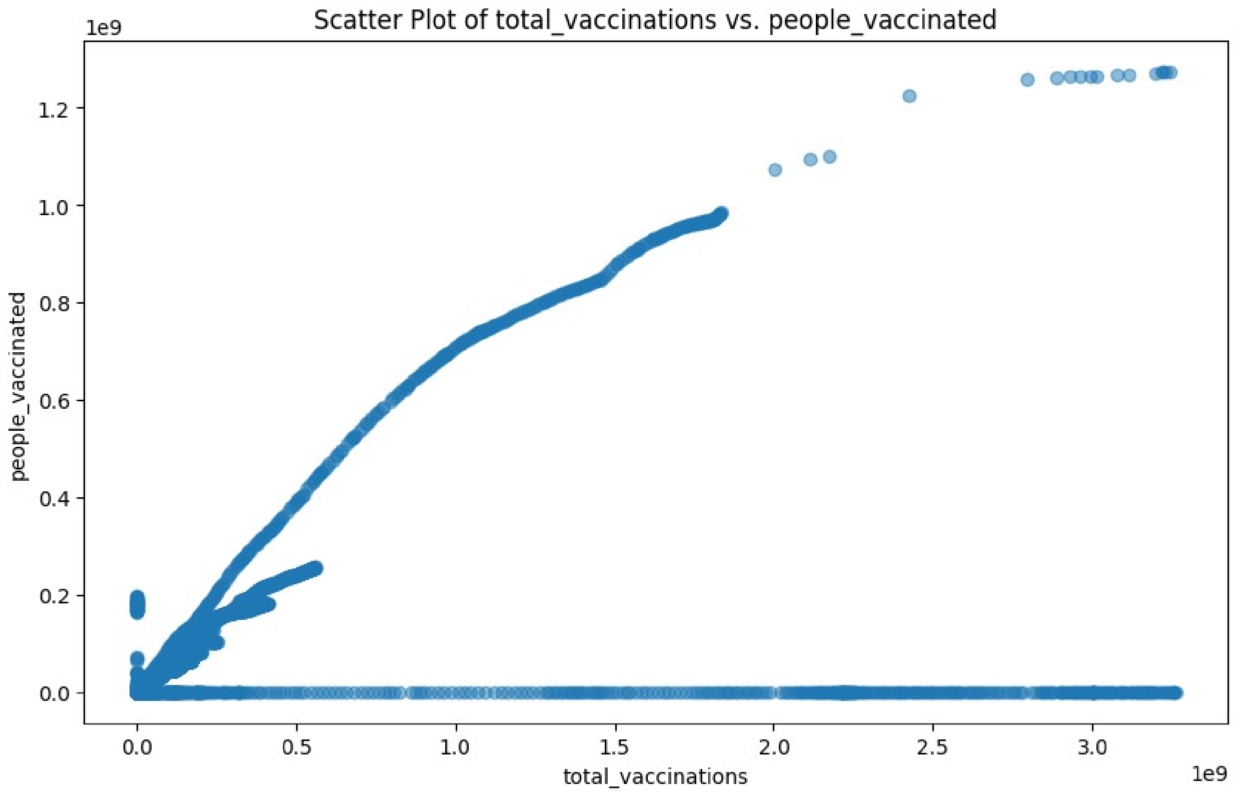
```
4       World Health Organization
...                           ...
187750         Ministry of Health
187751         Ministry of Health
187752         Ministry of Health
187753         Ministry of Health
187754         Ministry of Health

                                           source_website
location  \
0                                https://covid19.who.int/
Austria
1                                https://covid19.who.int/
Austria
2                                https://covid19.who.int/
Austria
3                                https://covid19.who.int/
Austria
4                                https://covid19.who.int/
Austria
...                                                   ...               .
..
187750  https://www.arcgis.com/home/webmap/viewer.html...
Germany
187751  https://www.arcgis.com/home/webmap/viewer.html...
Italy
187752  https://www.arcgis.com/home/webmap/viewer.html...
Liechtenstein
187753  https://www.arcgis.com/home/webmap/viewer.html...
Latvia
187754  https://www.arcgis.com/home/webmap/viewer.html...
Uruguay

            date_y            vaccine
0       2021-01-08            Moderna
1       2021-01-08            Novavax
2       2021-01-08  Oxford/AstraZeneca
3       2021-01-15            Novavax
4       2021-01-15  Oxford/AstraZeneca
...            ...                ...
187750  2021-02-04     Johnson&Johnson
187751  2021-02-03  Oxford/AstraZeneca
187752  2021-01-15     Pfizer/BioNTech
187753  2021-03-18     Pfizer/BioNTech
187754  2021-06-02  Oxford/AstraZeneca

[187755 rows x 18 columns]

df =
pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_va
ccinations.csv").head (5)
df['date'] = pd.to_datetime(df['date'])
df.fillna(0, inplace=True)
df

       country iso_code       date  total_vaccinations
people_vaccinated  \
0  Afghanistan      AFG 2021-02-22                 0.0
0.0
1  Afghanistan      AFG 2021-02-23                 0.0
0.0
2  Afghanistan      AFG 2021-02-24                 0.0
0.0
3  Afghanistan      AFG 2021-02-25                 0.0
0.0
4  Afghanistan      AFG 2021-02-26                 0.0
0.0

   people_fully_vaccinated  daily_vaccinations_raw  daily_vaccinations
\
0                      0.0                     0.0                 0.0

1                      0.0                     0.0              1367.0

2                      0.0                     0.0              1367.0

3                      0.0                     0.0              1367.0

4                      0.0                     0.0              1367.0


   total_vaccinations_per_hundred  people_vaccinated_per_hundred  \
0                             0.0                            0.0
1                             0.0                            0.0
2                             0.0                            0.0
3                             0.0                            0.0
4                             0.0                            0.0

   people_fully_vaccinated_per_hundred  daily_vaccinations_per_million
\
0                                  0.0                             0.0

1                                  0.0                            34.0

2                                  0.0                            34.0

3                                  0.0                            34.0

4                                  0.0                            34.0
```

```
                                                vaccines  \
0  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
1  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
2  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
3  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...
4  Johnson&Johnson, Oxford/AstraZeneca, Pfizer/Bi...

                 source_name            source_website
0  World Health Organization  https://covid19.who.int/
1  World Health Organization  https://covid19.who.int/
2  World Health Organization  https://covid19.who.int/
3  World Health Organization  https://covid19.who.int/
4  World Health Organization  https://covid19.who.int/
```

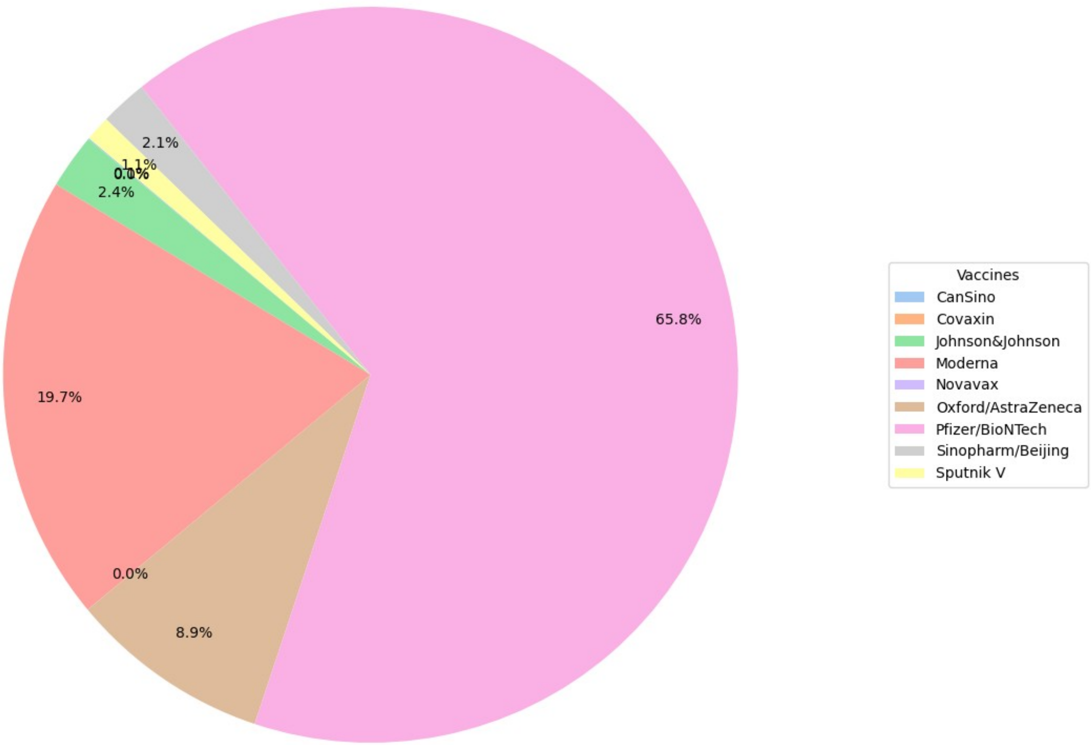
```python
import pandas as pd
import matplotlib.pyplot as plt
df =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')
additional_vaccines = ['CanSino', 'Pfizer/BioNTech',
'Johnson&Johnson', 'Covaxin', 'Novavax']
selected_vaccines = ['Moderna', 'Oxford/AstraZeneca',
'Sinopharm/Beijing', 'Sputnik V']+ additional_vaccines
df_selected_vaccines = df[df['vaccine'].isin (selected_vaccines)]
vaccine_totals=df_selected_vaccines.groupby('vaccine')
['total_vaccinations'].sum()
plt.figure(figsize=(10,6))
plt.bar(vaccine_totals.index, vaccine_totals.values, color='skyblue')
plt.xlabel('Vaccine Type')
plt.ylabel('Total Vaccinations')
plt.title('Total Vaccinations by Vaccine Type')
plt.xticks(rotation=45)
plt.show()
```



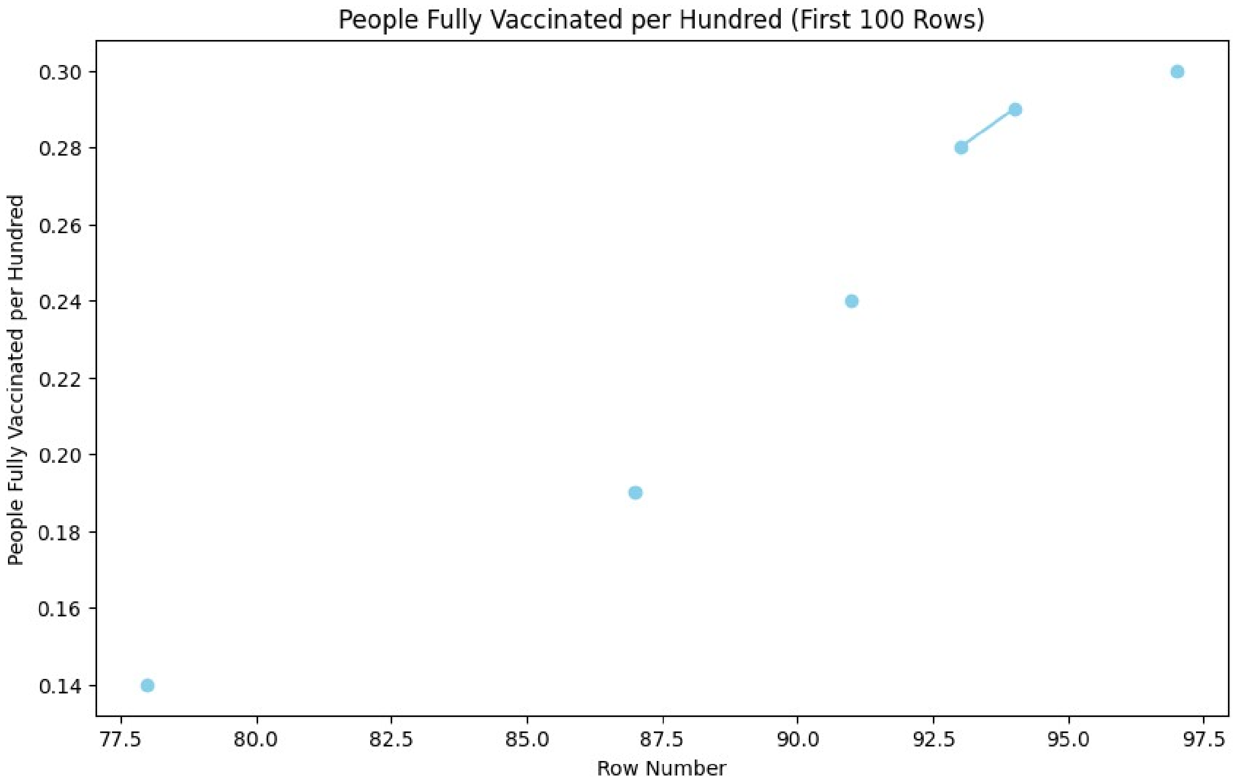
```
import pandas as pd
import matplotlib.pyplot as plt
df =
pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_va
ccinations.csv")
df['date'] = pd.to_datetime (df['date'])
df.fillna(0,inplace=True)
df = pd.get_dummies (df, columns=['country','iso_code'],
drop_first=True)
plt.figure(figsize=(10, 6))
x_variable='total_vaccinations'
y_variable="people_vaccinated"
plt.scatter(df[x_variable], df[y_variable], alpha=0.5)
plt.xlabel(x_variable)
plt.ylabel(y_variable)
plt.title(f'Scatter Plot of {x_variable} vs. {y_variable}')
plt.show()
```



```
import seaborn as sns

colors = sns.color_palette('pastel', len(vaccine_totals))

plt.figure(figsize=(12, 8))

wedges, texts, autotexts = plt.pie(vaccine_totals, autopct='%1.1f%%',
startangle=140, colors=colors, pctdistance=0.85)

plt.axis('equal')

plt.legend(wedges, vaccine_totals.index, title="Vaccines", loc="center
left", bbox_to_anchor=(1, 0, 0.5, 1))

plt.tight_layout()

plt.show()
```



```python
import pandas as pd

import matplotlib.pyplot as plt

df = pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_vaccinations.csv").head(100)

plt.figure(figsize=(10, 6))

plt.plot(df['people_fully_vaccinated_per_hundred'], marker='o', color='skyblue', linestyle='-')

plt.xlabel('Row Number')

plt.ylabel('People Fully Vaccinated per Hundred')

plt.title('People Fully Vaccinated per Hundred (First 100 Rows)')




plt.show()
```



```
import pandas as pd

df =
pd.read_csv("/kaggle/input/covid-world-vaccination-progress/country_va
ccinations.csv")

# Convert 'date' column to datetime format
df['date'] = pd.to_datetime(df['date'])

# Extract year and month
df['year'] = df['date'].dt.year
df['month'] = df['date'].dt.month

# Calculate the percentage
df['percentage_fully_vaccinated'] = (df['people_fully_vaccinated'] /
df['total_vaccinations']) * 100

# Sort the DataFrame by country, year, and month__
df_sorted = df.sort_values(by=['country', 'year', 'month'])

# Group by country, year, and month, then calculate the average
percentage for each month
result = df_sorted.groupby(['country', 'year', 'month'])
['percentage_fully_vaccinated'].mean()

# Reset the index to get the DataFrame format
```

```
result_df = result.reset_index()

# Print the result DataFrame
print(result_df)
```

```
          country  year  month  percentage_fully_vaccinated
0     Afghanistan  2021      2                          NaN
1     Afghanistan  2021      3                          NaN
2     Afghanistan  2021      4                          NaN
3     Afghanistan  2021      5                    16.675279
4     Afghanistan  2021      6                    23.651193
...           ...   ...    ...                          ...
3013     Zimbabwe  2021     11                    43.366796
3014     Zimbabwe  2021     12                    42.953565
3015     Zimbabwe  2022      1                    43.225408
3016     Zimbabwe  2022      2                    43.138566
3017     Zimbabwe  2022      3                    41.875884

[3018 rows x 4 columns]
```

```
import pandas as pd
import folium

# Load the dataset with total vaccinations by manufacturer
data =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')

# Filter data for Argentina,we can give any country we want.
argentina_data = data[data['location'] == 'Argentina']
total_vaccinations_by_vaccine = argentina_data.groupby('vaccine')
['total_vaccinations'].sum().reset_index()

# Get the latitude and longitude for Argentina
argentina_lat = -38.4161
argentina_lon = -63.6167

# Create a base map centered on Argentina
map = folium.Map(location=[argentina_lat, argentina_lon],
zoom_start=4)

# Generate popup content with vaccine names and total vaccinations
popup_content = '<br>'.join(f"{row['vaccine']} -
{row['total_vaccinations']}" for _, row in
total_vaccinations_by_vaccine.iterrows())

# Add a marker with the popup content
folium.Marker(
    location=[argentina_lat, argentina_lon],
    popup=folium.Popup(popup_content, max_width=300),
    icon=folium.Icon(color='blue')
).add_to(map)

# Show the map
map
```

```
<folium.folium.Map at 0x78c1c71144f0>
```

```
import pandas as pd

# Load the dataset
data =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')

# Calculate vaccination rate by vaccine type
vaccination_rate_by_vaccine = data.groupby('vaccine')
['total_vaccinations'].sum() / data.groupby('vaccine').size()

# Create a new DataFrame to store the result
result_df = pd.DataFrame({'vaccination_rate_by_vaccine':
vaccination_rate_by_vaccine})

# Merge the result DataFrame with the original data on 'vaccine'
data = data.merge(result_df, on='vaccine', how='left')

# Show the result
print(data)
```

```
             location        date            vaccine
total_vaccinations  \
0           Argentina  2020-12-29            Moderna
2
1           Argentina  2020-12-29  Oxford/AstraZeneca
3
2           Argentina  2020-12-29   Sinopharm/Beijing
1
3           Argentina  2020-12-29          Sputnik V
20481
4           Argentina  2020-12-30            Moderna
2
...               ...         ...                ...
...
35618  European Union  2022-03-29  Oxford/AstraZeneca
67403106
35619  European Union  2022-03-29     Pfizer/BioNTech
600519998
35620  European Union  2022-03-29   Sinopharm/Beijing
2301516
35621  European Union  2022-03-29            Sinovac
1809
```

```
35622  European Union  2022-03-29           Sputnik V
1845103

       vaccination_rate_by_vaccine
0                     1.552058e+07
1                     7.003092e+06
2                     7.241682e+06
3                     5.923586e+06
4                     1.552058e+07
...                            ...
35618                 7.003092e+06
35619                 3.879792e+07
35620                 7.241682e+06
35621                 5.556222e+06
35622                 5.923586e+06

[35623 rows x 5 columns]
```

```python
import pandas as pd

# Load the dataset
data = 
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccinations_by_manufacturer.csv',sep=',')

# Calculate total vaccinations by country
total_vaccinations_by_country = data.groupby('location')
['total_vaccinations'].sum()

# Convert the result to a DataFrame
result_df = total_vaccinations_by_country.reset_index()

# Rename the columns for better clarity
result_df.columns = ['Country', 'Total Vaccinations']

# Show the result
print(result_df)
```

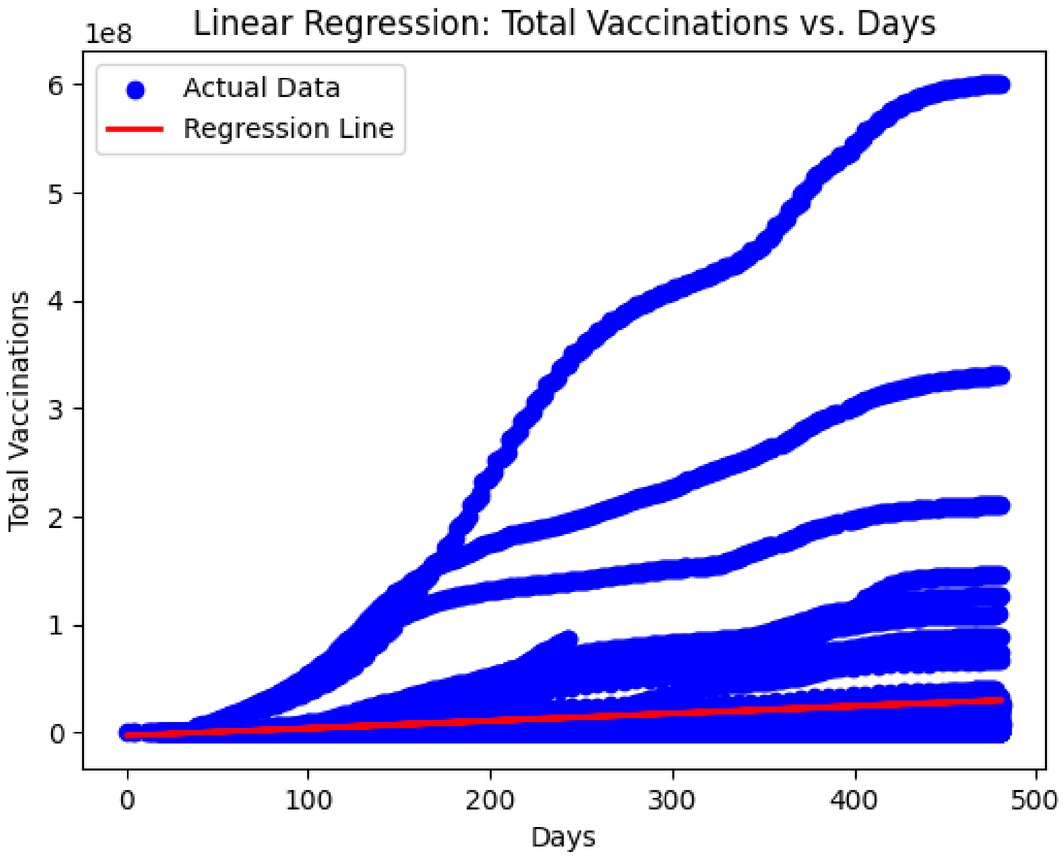
```
           Country  Total Vaccinations
0        Argentina         18678951288
1          Austria           596514759
2          Belgium           834395863
3         Bulgaria           134238313
4            Chile          9931757732
5          Croatia           180468380
6           Cyprus            55063408
7          Czechia          4104977325
8          Denmark           410370596
9          Ecuador          4599104870
10         Estonia            70424761
```

```
11  European Union        193020139251
12         Finland           373909900
13          France         32177039372
14         Germany         38982830332
15       Hong Kong          2684669290
16         Hungary           591312341
17         Iceland             4560663
18         Ireland           346279647
19           Italy         28306588441
20           Japan          3910422920
21          Latvia           596129865
22   Liechtenstein             2299059
23       Lithuania           154484516
24      Luxembourg            37541839
25           Malta            42587205
26           Nepal          1343230706
27     Netherlands          1116537275
28          Norway           356592335
29            Peru         10520125014
30          Poland          1824070504
31        Portugal           701877350
32         Romania          4151784964
33        Slovakia           223998563
34        Slovenia            99272786
35    South Africa           820872071
36     South Korea         21786515369
37           Spain          3262817401
38          Sweden           629157444
39     Switzerland          3691948362
40         Ukraine          4357666978
41   United States        139944068653
42         Uruguay          1664572676
```

```
import pandas as pd
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
# Load the dataset
data =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')

# Convert 'date' to numerical format (number of days since the start
date)
data['date'] = (pd.to_datetime(data['date']) -
pd.to_datetime(data['date']).min()).dt.days

# Prepare the feature matrix X and the target variable y
X = data[['date']]
y = data['total_vaccinations']
```

```
# Initialize the Linear Regression model
model = LinearRegression()
# Train the model
model.fit(X, y)

# Print the coefficients
print('Coefficient:', model.coef_[0])
print('Intercept:', model.intercept_)

# Predict total vaccinations
predictions = model.predict(X)

# Create a scatter plot of the actual data
plt.scatter(X, y, color='blue', label='Actual Data')
# Plot the regression line
plt.plot(X, predictions, color='red', linewidth=2, label='Regression Line')

# Add labels and title
plt.xlabel('Days')
plt.ylabel('Total Vaccinations')
plt.title('Linear Regression: Total Vaccinations vs. Days')
# Add legend
plt.legend()
# Show the plot
plt.show()
```

```
Coefficient: 67905.85580252815
Intercept: -2954051.2822800055
```



```
import pandas as pd
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error,
r2_score
import numpy as np

# Load the dataset
data =
pd.read_csv('../input/covid-world-vaccination-progress/country_vaccina
tions_by_manufacturer.csv',sep=',')

# Convert 'date' to numerical format (number of days since the start
date)
data['date'] = (pd.to_datetime(data['date']) -
pd.to_datetime(data['date']).min()).dt.days

# Prepare the feature matrix X and the target variable y
X = data[['date']]
y = data['total_vaccinations']

# Initialize the Linear Regression model
model = LinearRegression()
```

```python
# Training the model x,y
model.fit(X, y)

# Predicting total vaccinations
predictions = model.predict(X)

# Calculate evaluation metrics
rmse = np.sqrt(mean_squared_error(y, predictions))
mae = mean_absolute_error(y, predictions)
r_squared = r2_score(y, predictions)

# Printing the evaluation metrics
print(f'Root Mean Squared Error (RMSE): {rmse:.2f}')
print(f'Mean Absolute Error (MAE): {mae:.2f}')
print(f'R-squared (R2): {r_squared:.2f}')
```

```
Root Mean Squared Error (RMSE): 51122830.05
Mean Absolute Error (MAE): 20286696.16
R-squared (R2): 0.03
```