COVID Vaccines Analysis

Phase 3 :Development part

Objective

Our goal in this phase is to take our analysis to next level by applying advanced data analytics techniques. In this phase, an attempt has been made to analyze various information of COVID-19 World Vaccination Progress such as country, total Vaccinations , people vaccinated, daily vaccinations total vaccinations per hundred, people vaccinated per hundred, people fully vaccinated per hundred, vaccines and many more and used the specific techniques and best practices involved in data loading and preprocessing for vaccine analysis, highlighting their significance in ensuring the credibility and effectiveness of vaccine-related research.

Data loading

Data loading involves the collection and retrieval of vaccine-related data from various sources, such as healthcare databases, clinical trials, and vaccination records.

Data Preprocessing

Data Preprocessing, on the other hand, is the vital step where raw vaccine-related data is transformed and cleaned. This process encompasses data cleaning, transformation, and feature engineering to ensure that the data is suitable for further analysis

Given data set:

	country	iso_code	date	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_
0	Afghanistan	AFG	2021-02-22	0.0	0.0	NaN	NaN	NaN
1	Afghanistan	AFG	2021-02-23	NaN	NaN	NaN	NaN	1367
2	Afghanistan	AFG	2021-02-24	NaN	NaN	NaN	NaN	1367
3	Afghanistan	AFG	2021-02-25	NaN	NaN	NaN	NaN	1367
4	Afghanistan	AFG	2021-02-26	NaN	NaN	NaN	NaN	1367
...	...	...	...	...	...	...	...	...
86507	Zimbabwe	ZWE	2022-03-25	8691642.0	4814582.0	3473523.0	139213.0	6957
86508	Zimbabwe	ZWE	2022-03-26	8791728.0	4886242.0	3487962.0	100086.0	8342
86509	Zimbabwe	ZWE	2022-03-27	8845039.0	4918147.0	3493763.0	53311.0	9062
86510	Zimbabwe	ZWE	2022-03-28	8934360.0	4975433.0	3501493.0	89321.0	1006
86511	Zimbabwe	ZWE	2022-03-29	9039729.0	5053114.0	3510256.0	105369.0	1037

Importance of loading and processing dataset:

Loading and preprocessing the dataset is an important first step in building any machine learning model. However, it is especially important for vaccine analysis, as the datasets are often complex and noisy. By loading and preprocessing the dataset, we can ensure that the machine learning algorithm is able to learn from the data effectively and accurately.

Challenges involved in loading and preprocessing covid vaccine analysis dataset;

Missing Data

Another common issue that we face in real-world data is the absence of data points. Most machine learning models can't handle missing values in the data, so you need to intervene and adjust the data to be properly used inside the model.

Scaling the features:

It is often helpful to scale the features before training a machine learning model. This can help to improve the performance of the model and make it more robust to outliers. There are a variety of ways to scale the features, such as min-max scaling and standard scaling.

1.Loading the dataset

Loading the dataset using machine learning is the process of bringing the data into the machine learning environment so that it can be used to train and evaluate a model.

1.Identify the dataset:

The first step is to identify the dataset that you want to load. This dataset may be stored in a local file, in a database, or in a cloud storage service.

2.Load the Dataset:

Load your dataset into a Pandas DataFrame**.** The quality and reliability of data can significantly impact the outcomes of vaccine analysis, making it imperative to have robust data loading procedures in place.

Program:

```
vaccine_df = pd.read_csv('/content/drive/MyDrive/country_vaccinations.csv')

vaccine_df
```

3. Exploring data:

Perform EDA to understand your data better. This includes checking for missing values, exploring the data's statistics, and visualizing it to identify patterns.

Program

```
vaccine_df.isnull().sum()  # Check for missing values
```

Output

```
country                                0
iso_code                               0
date                                   0
total_vaccinations                 42905
people_vaccinated                  45218
people_fully_vaccinated            47710
daily_vaccinations_raw             51150
daily_vaccinations                   299
total_vaccinations_per_hundred     42905
people_vaccinated_per_hundred      45218
people_fully_vaccinated_per_hundred  47710
daily_vaccinations_per_million       299
vaccines                               0
source_name                            0
source_website                         0
dtype: int64
```

Explore statistics

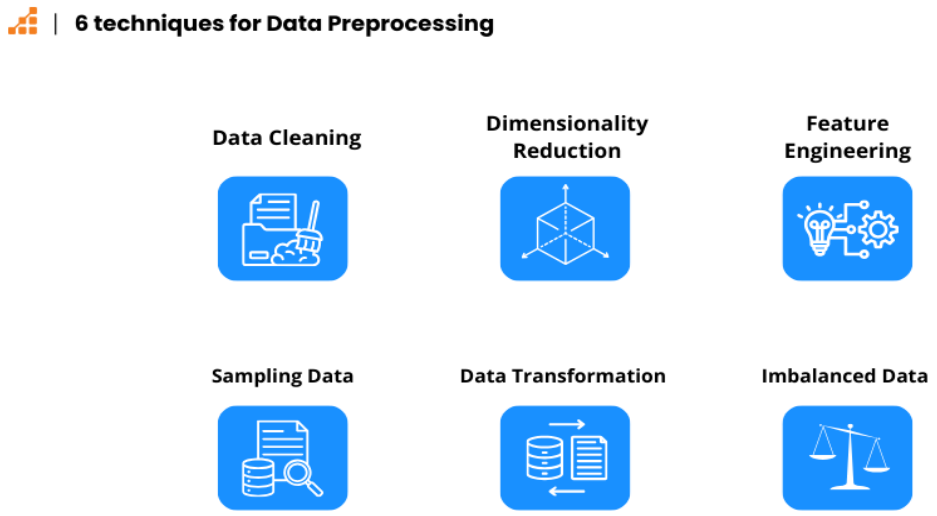
vaccine_df.describe()

Output

	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_va
count	4.360700e+04	4.129400e+04	3.880200e+04	3.536200e+04	8.6213
mean	4.592964e+07	1.770508e+07	1.413830e+07	2.705996e+05	1.3130
std	2.246004e+08	7.078731e+07	5.713920e+07	1.212427e+06	7.6823
min	0.000000e+00	0.000000e+00	1.000000e+00	0.000000e+00	0.0000
25%	5.264100e+05	3.494642e+05	2.439622e+05	4.668000e+03	9.0000
50%	3.590096e+06	2.187310e+06	1.722140e+06	2.530900e+04	7.3430
75%	1.701230e+07	9.152520e+06	7.559870e+06	1.234925e+05	4.4098
max	3.263129e+09	1.275541e+09	1.240777e+09	2.474100e+07	2.2424

4.**Preprocess the dataset:**

Once the dataset is loaded into the machine learning environment, you may need to preprocess it before you can start training and evaluating your model. This may involve cleaning the data, transforming the data into a suitable format.



Data cleaning: This involves identifying and correcting errors and inconsistencies in the data. For example, this may involve removing duplicate records, correcting typos, and filling in missing values.

Feature Scaling: Normalize or standardize numerical features to bring them to a common scale. Common methods include Min-Max scaling (scaling features to a specific range) and z-score normalization (scaling features to have a mean of 0 and a standard deviation of 1).

Feature Engineering: Create new features or modify existing ones to capture more meaningful information from the data. This may involve mathematical transformations, interaction terms, or aggregations.

Data transformation: It is a critical aspect of data preprocessing that involves converting and modifying the data to make it more suitable for analysis. It can help improve the performance of machine learning models, enhance the interpretability of the data, and ensure that it aligns with the assumptions of certain statistical techniques.

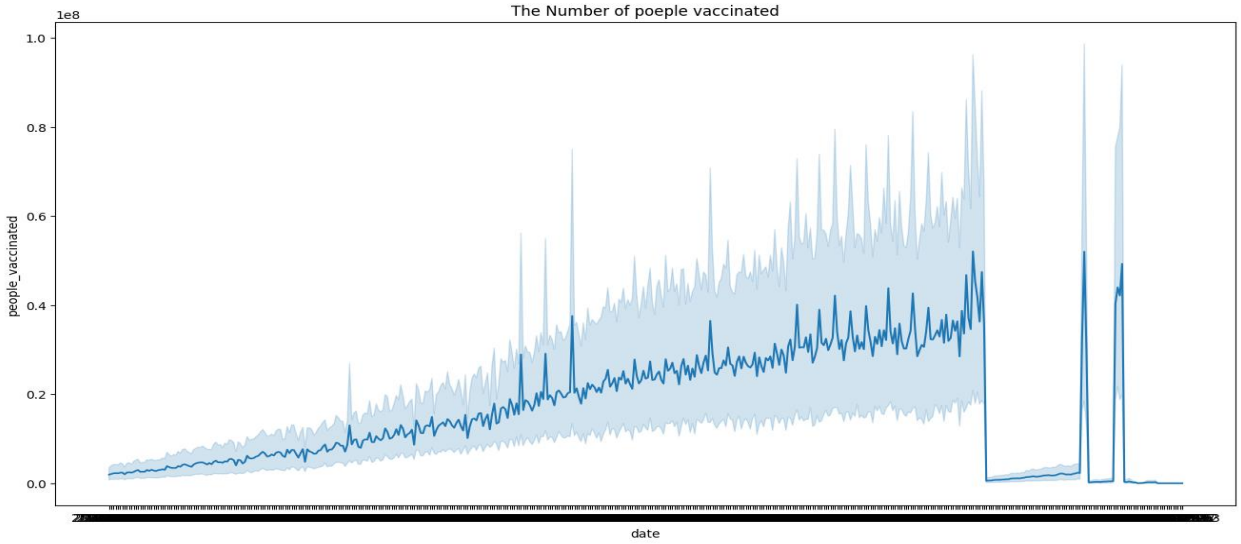
```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt
```

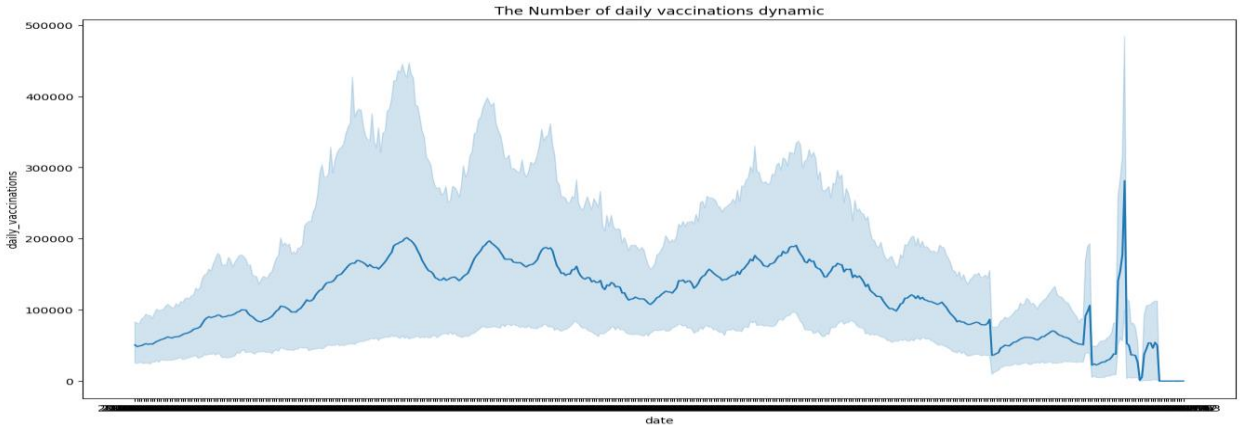
```
import seaborn as sns
plt.figure(figsize=(16,8))
sns.lineplot(x=vaccine_df.date, y=vaccine_df.people_vaccinated)
plt.title('The Number of poeple vaccinated')
plt.show()
```

Output



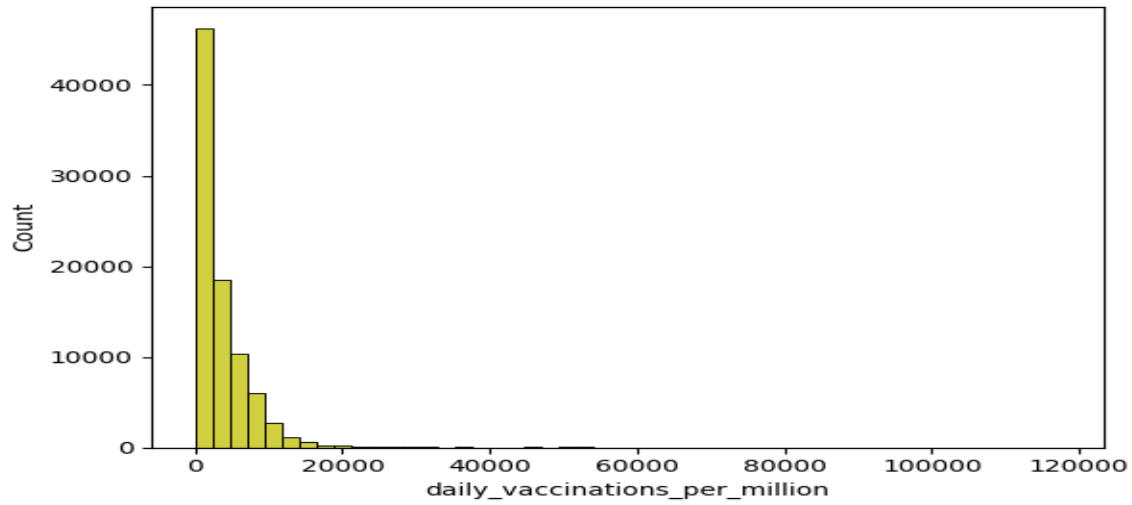

```
plt.figure(figsize=(16,8))
sns.lineplot(x=vaccine_df.date, y=vaccine_df.daily_vaccinations)
plt.title('The Number of daily vaccinations dynamic')
plt.show()
```

Output



sns.histplot(vaccine_df, x='daily_vaccinations_per_million', bins=50, color='y')

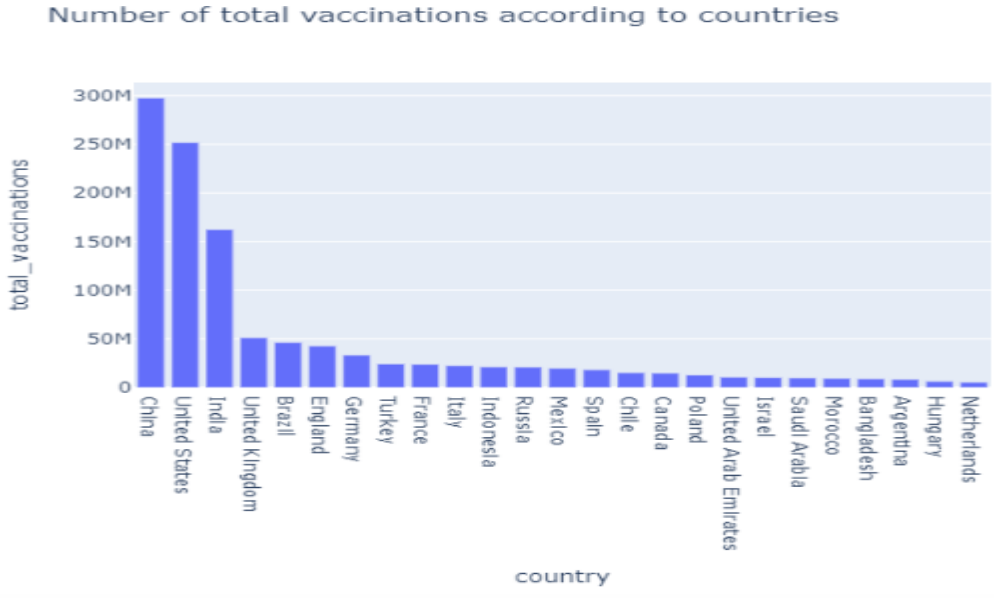
Output



data = vaccine_df[['country','total_vaccinations']].nlargest(25,'total_vaccinations')

fig = px.bar(data, x = 'country',y = 'total_vaccinations',title="Number of total vaccinations according to countries",)fig.show()

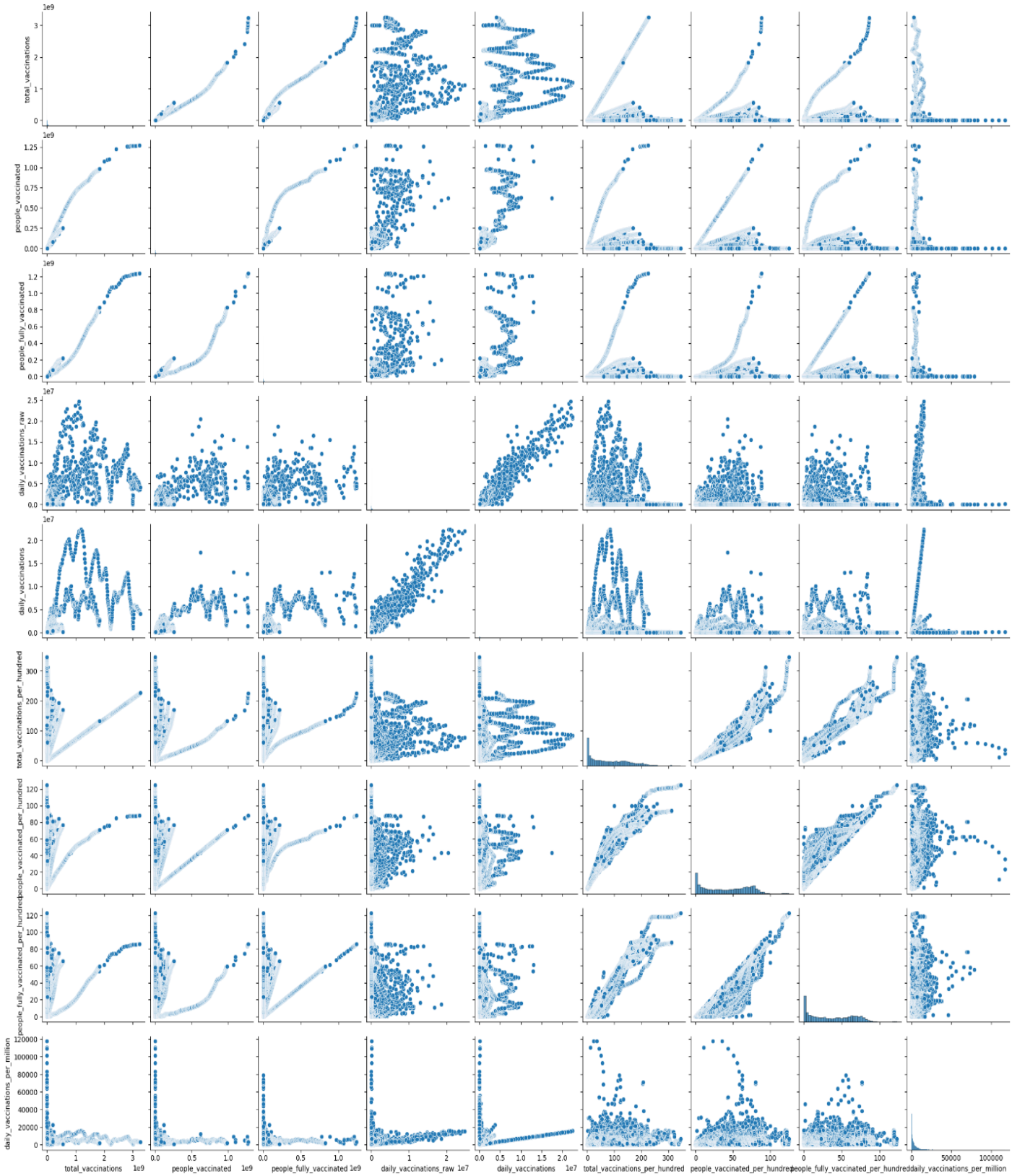
Output



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

sns.pairplot(vaccine_df)

Output

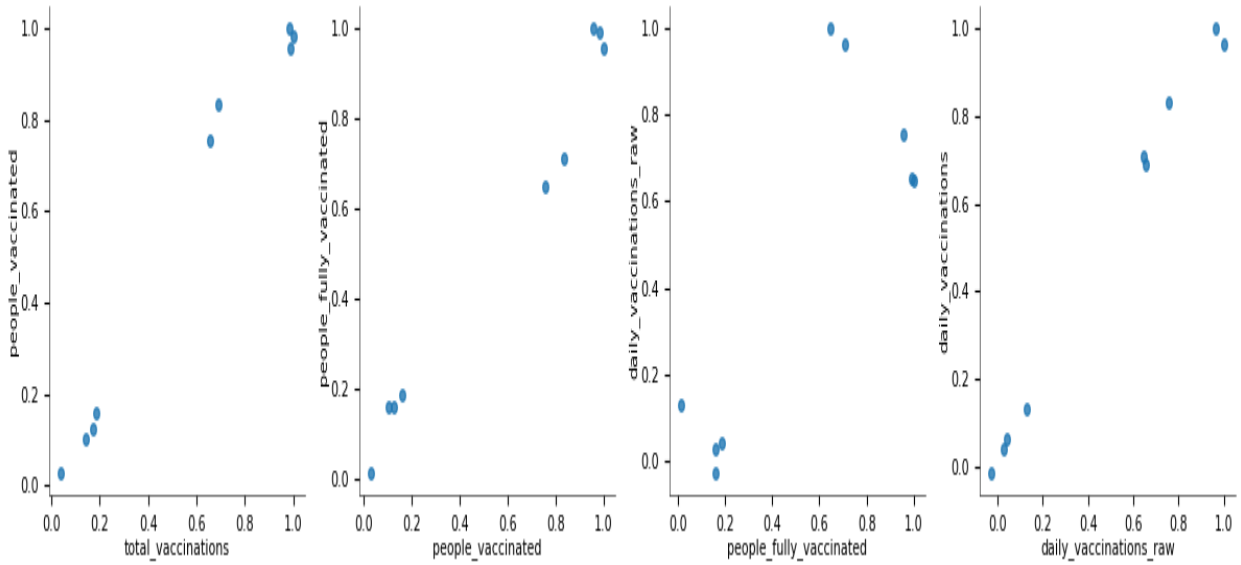

total_vaccinations
people_vaccinated
people_fully_vaccinated
daily_vaccinations_raw
daily_vaccinations
total_vaccinations_per_hundred
people_vaccinated_per_hundred
people_fully_vaccinated_per_hundred
daily_vaccinations_per_million
1e9
1e7

vaccine_df.corr(numeric_only=True)

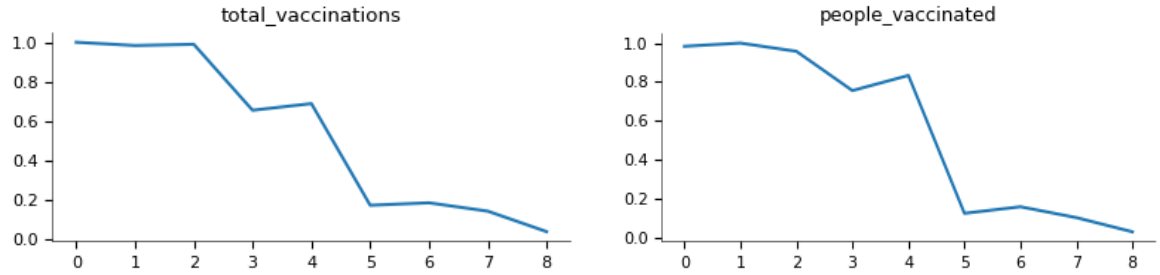
Output

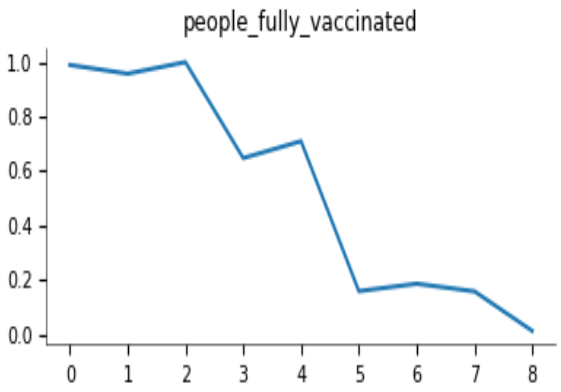
index	total_vaccinations	people_vaccinated	people_fully_vaccinated	daily_vaccinations_raw	daily_vaccinations	total_vaccinations_per_hundred
total_vaccinations	1.0	0.983438280596498	0.9896813381301297	0.6547117881908026	0.6885018889121146	0.17229710004672275
people_vaccinated	0.983438280596498	1.0	0.9575994800578601	0.7555402250789669	0.8334332974829378	0.12393803599973728
people_fully_vaccinated	0.9896813381301297	0.9575994800578601	1.0	0.647573972663791	0.7097681654065912	0.1590262533355807
daily_vaccinations_raw	0.6547117881908026	0.7555402250789669	0.647573972663791	1.0	0.96551657258391	0.02932884050938329
daily_vaccinations	0.6885018889121146	0.8334332974829378	0.7097681654065912	0.96551657258391	1.0	0.0422272861988585
total_vaccinations_per_hundred	0.17229710004672275	0.12393803599973728	0.1590262533355807	0.02932884050938329	0.0422272861988585	1.0
people_vaccinated_per_hundred	0.18464905459019076	0.15777531767489797	0.18636873471491208	0.042445074564014224	0.06256586245695953	0.9653293137912788
people_fully_vaccinated_per_hundred	0.14225214870015712	0.10171739078725649	0.15828335879738206	-0.027884824010809273	-0.014054926124652107	0.9754546830947068
daily_vaccinations_per_million	0.038298146800641905	0.028720142515809583	0.013220268364296078	0.13107810399599185	0.13382226191364244	0.18460888459647887

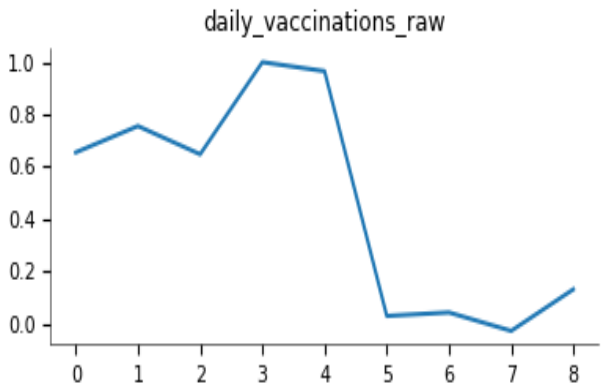
2-d Distributions



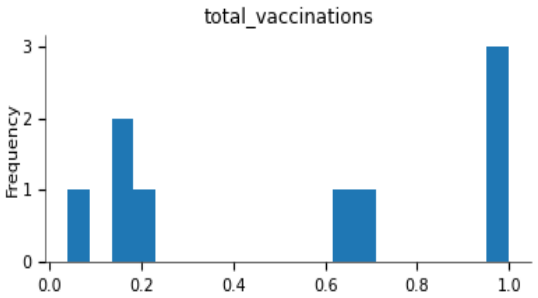
Values

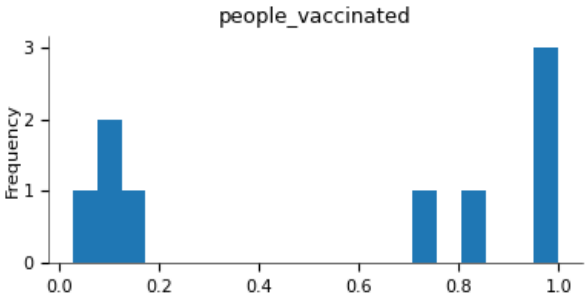


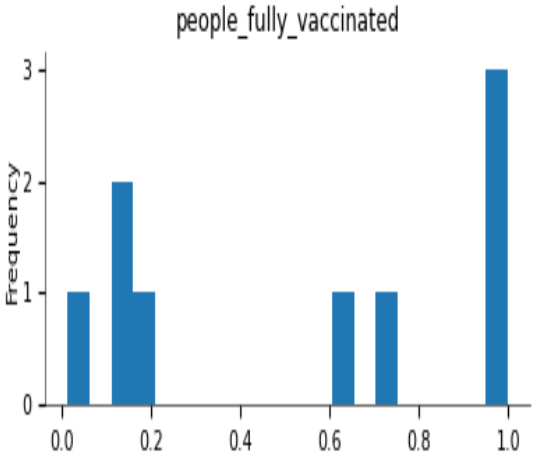


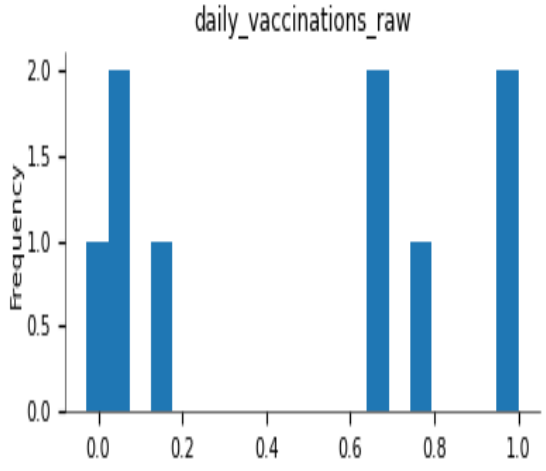


Distributions





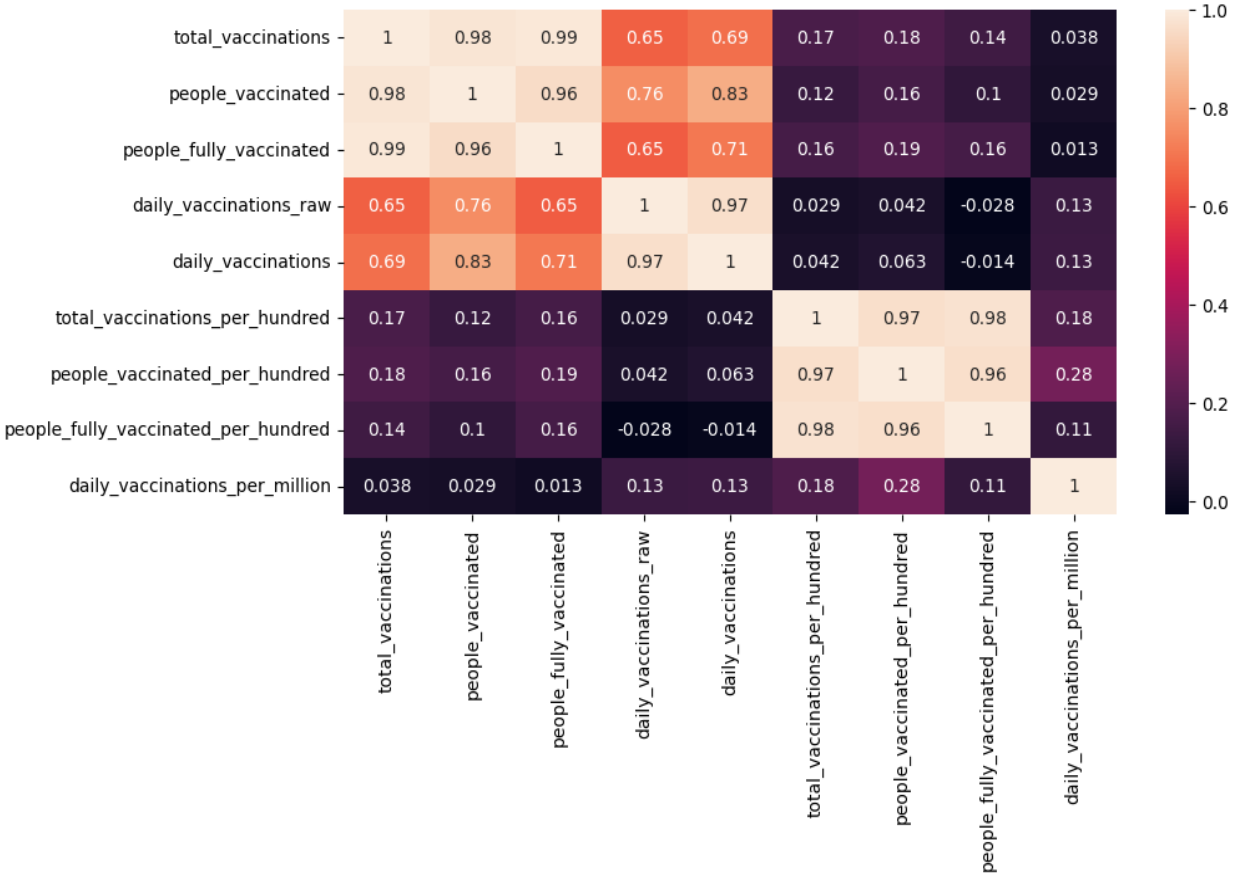




plt.figure(figsize=(10,5))

sns.heatmap(vaccine_df.corr(numeric_only = True), annot=True)

Output



Conclusion:

Data loading and preprocessing for vaccine analysis serve as the critical initial steps that empower researchers and healthcare professionals to make informed decisions about vaccine development, distribution, and safety. The quality, accuracy, and suitability of the data at this stage are pivotal in determining the success of subsequent analyses. Through diligent and systematic data handling, we can harness the power of data-driven insights to address public health challenges and contribute to the betterment of global health.